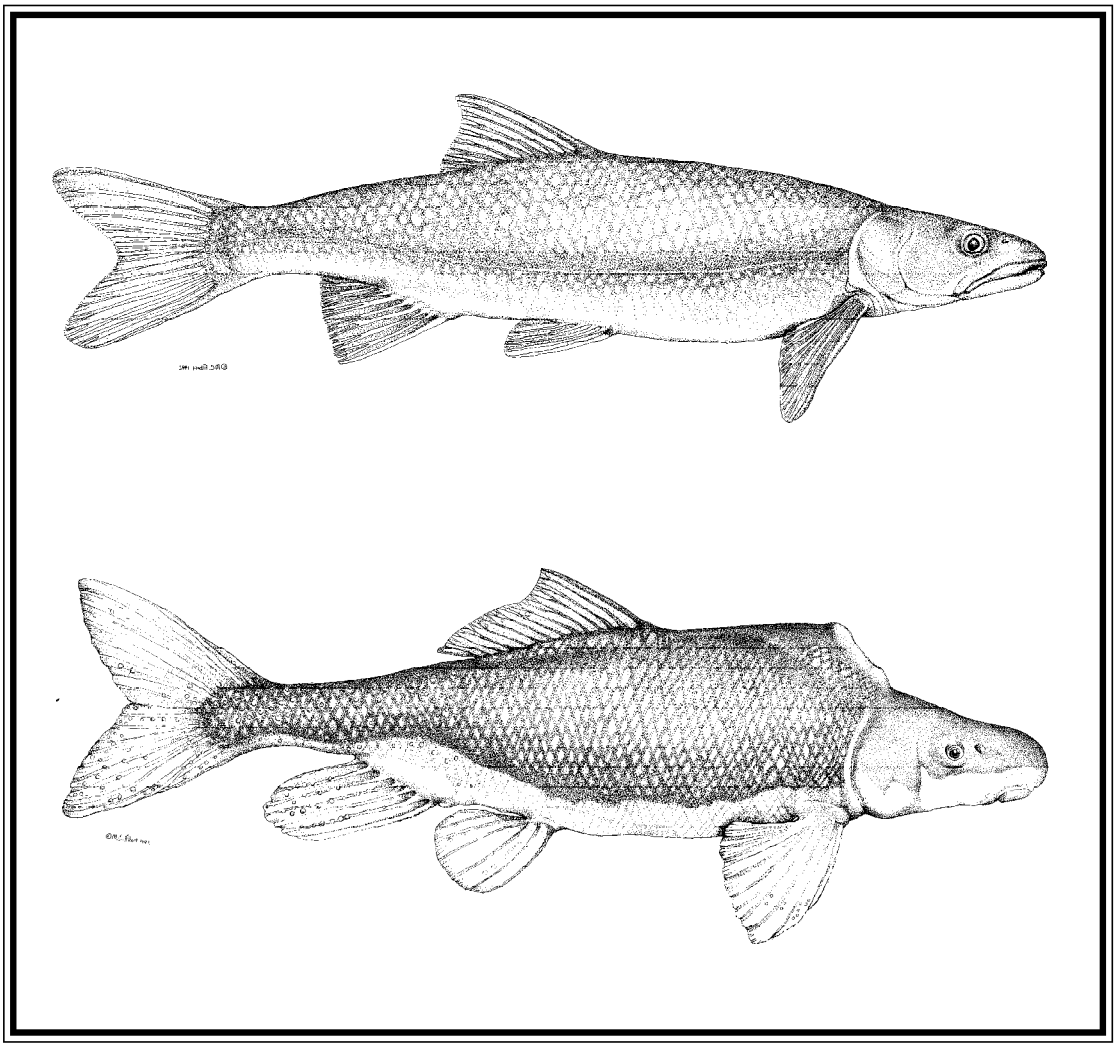


The endangered Colorado pikeminnow (top) and razorback sucker (bottom) of the San Juan River.

Response to Comments on the Flow Recommendations for the San Juan River Draft Report (December 4, 1998)

May 1999

Responses Prepared by:
Paul B. Holden and
Ronald D. Bliesner

Prepared for:
The San Juan River Basin Recovery Implementation Program
Biology Committee

PREFACE

This appendix is a response to comments that were submitted by the Peer Review Panel and members of the Coordination Committee on the final draft version of the Flow Recommendations for the San Juan River, dated December 4, 1998. Many of the comments were responded to by making changes in the main document, thus creating this final document. Many other comments did not elicit a change in the document, but required a response to answer the comment. Many of these latter types of comments questioned assumptions in the document, or wondered why certain features were not included in the document. The responses have been reviewed by the Biology Committee and they are in agreement that the responses reflect the overall thinking of that committee.

To respond to comments, electronic versions of comment letters were obtained and responses were made to each comment that warranted a response. Comment letters were reproduced in their entirety except for some letterheads that were not obtained electronically. Where page numbers are noted, they refer to pages in the December 4, 1998, draft document rather than this final document.

Comments were received from the following individuals:

Peer Review Panel

Dr. Ellen Wohl (did not require a response)
Dr. David Galat
Dr. Ron Ryel
Dr. Clark Hubbs (did not require a response)

Coordination Committee

John Whipple, State of New Mexico
Les Taylor and Jessica Aberly, Jicarilla-Apache Tribe
Errol Jensen, Bureau of Reclamation
Tom Pitts, Water Development Interests
Randy Seaholm, State of Colorado

COMMENT LETTERS AND RESPONSES

Paul Holden
BIO/WEST, Inc.
1063 West 1400 North
Logan, UT 84321

Dear Paul: 28 Sep. 1998

I have now had a chance to read the draft report on "Flow Recommendations for the San Juan River" (16 Sep 1998). I focused my attention on the portions of the report relating to hydrology and geomorphology. In general, I think that the report is well-organized and written, and represents a great deal of very thorough, careful work. My concerns following the last meeting of the review panel, in May 1998, were addressed in this document with the explanation of how bankfull discharge was determined, and the list of habitat types designated for the San Juan River. I think that the process followed for developing flow recommendations on the San Juan River represents a model that can be usefully applied to other regulated rivers with endangered species concerns.

I realize that the process of making flow recommendations for the San Juan River will involve on-going changes and adaptive management, as stressed throughout the flow recommendations report. My suggestions for continued future research related to geomophology are (1) to develop a system-wide sediment budget, and 92) to use 2-dimensional flow and sediment transport modeling to study the effect of changing water and sediment discharge regimes on backwater habitats. At present, the conceptual models of how the San Juan River adjusts to changing flow regimes are black-box in that they are based on observed changes and historical information, rather than specific, quantitative knowledge of processes such as sediment movement and channel response. Even as approximate quantification of sediment inputs, storage, and outputs from the San Juan River corridor would help to explain long-term trends or different channel responses through time to the same discharge level, for example. A system-wide sediment budget could be used in a manner analogous to the RiverWare model in that it would be more feasible than at present to evaluate the system-wide effects of changes in one component (such as tributary sediment input). Similarly, 2d models which simulate the secondary flow patterns that are likely responsible for creating and maintaining backwater habitats could be used to more effectively evaluate the response of these habitats to changes in flow regime.

In closing, I would like to reiterate that I am ver impressed with the hydrologic and geomorphic studies conducted on the San Juan River in connection with developing flow recommendations for endangered species recovery. My only specific comments at this point are suggestions for possible future directions for the program.

Sincerely,

Ellen Wohl

Ellen Wohl
Associate Professor of Geology
Colorado State University

Review of Draft Report:
Flow Recommendations for the San Juan River
David L. Galat, Ph.D.

This review covers the 16 September 1998 Draft for Chapters 1-6 and the 4-December 1998 Draft for Chapters 7 and 8. It treats only the technical aspects of the Report as they relate to the project objectives.

Strengths

My professional emphasis on large river ecology has familiarized me with research on many large rivers throughout the world. The thoroughness, goal orientated approach, and overall research quality of this effort rank it very high among those I've encountered. The greatest strength of the effort is linking hydrology, geomorphology and life history requirements of the listed fishes to recommend flow requirements. A second strength is that the flow recommendations incorporate statistical variability rather than relying on mimicry of any specific annual hydrograph. Importantly, the approach is adaptive in that modifications in recommendations are incorporated in the plan based on new information. Additionally, the SJRIP Biology Committee recognized the difficulty of evaluating responses of wild endangered fishes to changes in Navajo Dam flows in the San Juan and proactively responded by stocking squawfish and razorbacks. While some might find fault with this approach, in my opinion, it was the best strategy to maximize information learned from controlled flow releases.

The amount and detail of life-history information briefly summarized for the Colorado squawfish and razorback sucker is impressive compared with many non-game species. The authors have capitalized on this knowledge base to compensate for the low numbers of these fishes currently present in the San Juan River and provided a most comprehensive analysis of flow and habitat effects on critical life-history events. They abstracted relevant portions of detailed studies (e.g., invertebrates, detritus and periphyton biomass) to determine flow needs of fishes, without dwelling on the details.

The San Juan and Green and Colorado rivers were contrasted whenever possible to show similarities and differences. This placed the SJRIP effort into a regional context, but also emphasized its uniqueness.

This report does an excellent job of summarizing and integrating what is known about the target fishes life histories from a wide variety of sources and relating them to the San Juan. Moreover, it presents realistic and objective conclusions which, it is acknowledged, may not always be clear cut. For example, the authors state based on a thorough review of the evidence that photoperiod, temperature, and flow all play a role in cuing squawfish spawning.

Chapter 7 was very helpful to a non-hydrologist like myself to understand the fundamentals of the modeling process without too much detail. Sufficient qualifications were included to assure the

reader that what is presented is a range of possibilities given probable conditions and that the recommendations made are preliminary and based on best available information at the time.

Success of the San Juan Recovery Program depends upon a positive response of the targeted fishes to the flow recommendations. A standardized monitoring program that focuses on specific biological response variables (e.g., larval fish density below known spawning areas, juvenile density in autumn from critical habitats, numbers of adult fishes on spawning areas) within a hydrologic and geomorphic context is essential for at least a decade. Because the Program uses an adaptive approach the models and flows can be adjusted during the monitoring as information is gained.

General Suggestions for Improvement

Non-native fishes. The report does an excellent job of describing the documented and suspected impacts of non-native fishes to the targeted fishes. Additionally, it is indicated that a more natural hydrograph may benefit native over non-native fishes. However, it is unlikely that non-natives will be extirpated by a natural flow regime and their continued impact may remain an impediment to achieving the full restoration potential of the native San Juan fish fauna. I suggest this reality be considered in relation to expectations of the benefits of restoring a natural hydrograph and incorporated into your adaptive management strategies. **RESPONSE:** *The Biology Committee is well aware of this potential and has incorporated it into its future activities.*

The amount of methodological details in Chapter 4: Response to Research Flows, seems excessive and out of balance relative to the biological information presented elsewhere. I believe it detracts from the reader grasping the main geomorphic effects of what the research flows accomplished. Perhaps methodological details and the hydrological nuances should be summarized elsewhere. In general, a bit more even treatment of biological and physical information is suggested. Having biologists edit the physical sections and visa-versa is a good approach to accomplish this. **RESPONSE:** *We understand the basis of the concern. However, since the flow recommendations are based so heavily in the hydrology/geomorphology relationships, earlier drafts were criticized by others for not including sufficient detail. The detail was added in response to those criticisms.*

If high flows are required to move materials and they ultimately move through the system. Where do new materials (e.g. cobble) come from? Contrasting the relative importance of lateral sources (some of which may come from bank erosion of adjacent private lands) and downstream transport in a system where Navajo Dam has reduced supply is an important consideration. What will be a range of projected channel configurations in 50 years and where will cobble come from if the system is laterally and longitudinally constrained, or is it? **RESPONSE:** *Navajo Dam cut off the upstream cobble source. The Animas River still provides a small cobble source from upstream as does the LaPlata River (both unregulated). It is likely that the bulk of the new cobble in the system will come from bank erosion and newly formed secondary channels created during over-bank flow events. With a flow regime reduced from historic pre-dam conditions, cobble transport is also reduced. Fortunately, the channel is not laterally constrained over much of its length once on the Navajo Reservation (Below RM 158). While we have not attempted to predict the long term cobble balance,*

an examination of the channel configuration since 1934 compared to the changes we have seen during the research period, indicate that the general nature of the channel should not markedly change over what we see today for a very long time. Continued monitoring will help evaluate any trends that may be of concern. No change in the report was made in response to this comment.

There is increasing evidence that in addition to backwaters, main channel margins, especially in areas of complex point and lateral bars supply important nursery habitat for age 0 fishes. (e.g., Schiemer and Waidbacher 1992. River Cons. & Manage. Boon, Calow and Petts [eds] and references therein). I believe these equate to the term "slackwaters" in Table 2.1. Have the contributions of these areas been investigated for larval and juvenile squawfish and razorback suckers in the San Juan or other Colorado River tributaries? **RESPONSE:** *Yes, young squawfish used low velocity habitats such as slackwaters in the San Juan River. This information is discussed on pages 3-10 and 4-48. These channel margin habitats will be sampled more frequently under the proposed long term monitoring protocols being developed by the Biology Committee.*

Much of the fish sampling reported in Chapter 4, including specific species and life stages, was done by a variety of agencies (WDWR, NMGF, USFWS, USBR, UNM, etc.) using a variety of gears, various personnel, and at different times and flows within and among years. How standardized sampling protocols were for the same species and life stages among agencies within and across years is an issue that could influence interpretation of the results. **RESPONSE:** *Standardization of collecting methods was implemented throughout much of the 7-year research period. The primary sampling factors that varied were sampling times and sampling intensity. We have noted this concern on page 4-40, 4-53, and other pages in Chapter 4.*

It is particularly important that any monitoring program instituted on the San Juan be consistent so that differences or similarities observed can be attributed to habitat, flow and species traits rather than gear or researcher variability. I'm involved in a 7 group consortium that has just completed sampling benthic fishes along the 3,300 km Missouri River for three years. We've used a set of standard operating procedures (SOPs) to accomplish this (to illustrate the approach they can be found at www.cerc.cr.usgs.gov/pubs/benfish/title_page.htm). While the details for the San Juan would differ greatly from the Missouri the need for standardization is evident. **RESPONSE:** *We agree and have attempted to correct any problems with the Monitoring Plan that is presently being developed by the Biology Committee.*

I'm concerned at the amount of "grey" literature referenced to substantiate recommendations when many of these reports were completed several years ago. While it should not be the intent of this project to publish peer reviewed papers in professional journals, establishing scientific credibility of the research (e.g., Ryden and Alm 1996 on San Juan and numerous papers cited on Green and Yampa Rivers) is important if your recommendations are to be accepted by the various interest groups. **RESPONSE:** *For one reason or the other, much of the Colorado River information has been reported in agency reports rather than peer reviewed journals. We have used peer reviewed citations as much as possible, but some information remains in final report format.*

There are many terms that are specific to this Report that do not appear in the Glossary. Presently it contains general biological and hydrological terms but lacks those specific to the Report. For example, the essence of the Report is the modeled flow scenarios, yet essential terms like pre-dam, post-dam, study period, baseline, etc. aren't in the Glossary. I include a few terms that stood out to me. **RESPONSE:** *We have expanded the glossary to include more terms.*

SPECIFIC COMMENTS

Inside Cover

Include a format for citing the document and chapters within it someplace up front. This is important so that others can accurately reference the document or portions therein.
Here's one sample format.
Citing the entire Report: Holden, P. B. (Ed). 1999. Flow recommendations for the San Juan River. SJRIP Biology Committee. Where published and available??

Chapter in Report: R. Bliesner and V. Lamarra. 1999. Chapter 2: Geomorphology, hydrology and habitat of the San Juan River. Pages 2.1-2.29. *In* P. B. Holden (ed)....

This is just an example and may not be correct. However, do whatever is required to be sure appropriate credit is given to contributors, but don't avoid a formal citation format for fear someone will be offended because of the order of their appearance. **RESPONSE:** *We have added a page to show a suggested citation format after the front cover.*

Executive Summary

S-1. I suggest repeating here (S-1) an abbreviated summary of the importance of the natural flow regime and the coupling of hydrology, geomorphology and biology (pg 1-4). This is the rationale underlying the entire SJRIP effort and the lay reader needs to be better educated as to its underpinnings. **RESPONSE:** *This has been inserted.*

S-5--S-8. Flow Recommendations A.-G. Despite the preparatory paragraph explaining these recommendations, they are still not very clear to me. The entire Report depends on everybody understanding these recommendations. Avoid hydrological and statistical jargon here and don't skimp on text to sacrifice clarity for brevity.

Duration and frequency terms need clarification. Duration terms are days per what? Month, year, decade? I think for A. you mean: 5 days minimum between 3/1 and 7/31? The expression of frequency is too arcane for the non-hydrologist. 20% on average of what? Do you mean 20% of the years on average per decade? "Maximum period without...is 10 years", is Greek. Frankly, even with the text explanation I don't know what this means, so I doubt your general reader will either. Perhaps giving an example would help? Much of this is explained in Chapter 8, but not everyone will read it, so sufficient background must be provided in the Ex. Sum. for it to stand alone.

E. Saying, "similar to historical conditions", is vague. Tell what the historical conditions are?
RESPONSE: *We have followed your above suggestions and have expanded the definitions in both the Executive Summary and in Chapter 8.*

I don't agree that maintaining a similar peak of Q max timing to historical conditions will necessarily yield ascending and descending hydrograph limbs similar to historic conditions. You can achieve the date of Qmax by opening the gates completely for three days and then shutting them off which results in steep ascending and descending hydrograph limbs, or your could increase and decrease flows more gradually achieving the same date of Q max but with more gradual rising and falling hydrograph limbs. I think, if you want a rate of hydrograph rise and fall then providing rate of change of flow (e.g., + or - cfs/day) is what's needed (i.e. the ramp up and ramp down volumes ?).
RESPONSE: *Since Navajo Dam only controls about 50% of the flow in the area of concern, the nature of the release shape is influenced both by release ramp rates and timing of the peak. The result of this recommendation must be taken in the context of the other recommendations being met. Specifying the mean date and acceptable range of standard deviation is important to mimic the historic timing of the ascending and descending limbs. The language has been edited to include this qualification and make in clearer.*

Chapter 1

1-1. Correct use of fish versus fishes. **RESPONSE:** *We have checked usage of these terms again throughout the document.*

1-4. Try and cite more primary literature. Richter et al. 1998 (Reg. Rivers 14:329-340) and other papers of his cited therein are more credible than an abstract for an oral paper. Richter's papers preach the natural flow regime in a very articulate and convincing manner. **RESPONSE:** *We have added better references per your suggestion.*

Chapter 2

2-26. "Production" was not either measured nor "estimated". Standing crop or biomass (gm/m^2) was measured. Production is a rate, e.g. $gm/m^2/day$. Equating standing crop to production is similar to saying volume (cf) equals discharge (cfs). Call it biomass. **RESPONSE:** *We have made this change.*

Chapter 3

3.3. P. 4. Saying temperature "was less variable" than date of spawning is somewhat misleading, particularly when you later say that photoperiod may be more important than temperature for cuing spawning. Its comparing apples and oranges. Just say temperature varied from 16 to 19C.
RESPONSE: *We have corrected this sentence to conform to the conclusions developed by Bestgen et al. (1998).*

3-16. I'd be a bit careful in implying studies from Lake Mohave are applicable to a riverine system without a word of caution. Research by Papoulias and Minckley (TAFS, 1989?) indicated starvation

might also be a contributing factor to low larval survival.. The 30 mm razorback suckers reported by Minckley from a predator free environment also were in a food rich environment where growth was very rapid. Obviously, a food rich environment where growth is fast reduces the window where larval fishes are susceptible to intense predation. Like spawning cues, its likely a combination of factors such as food availability, habitat and introduced predators that result in low larval survival and this should be acknowledged.
RESPONSE: *We agree and have added a sentence on page 3-17 to make this point clearer.*

Chapter 4

4-5, p3. Avoid using terms like "is obvious". If it's so obvious, why was it necessary to measure? More importantly the scour/fill pattern associated with runoff/non-runoff periods is not obvious to me since there is no indication on the Figure which dates are runoff and which are non-runoff. I can approximate by referring back to annual hydrographs, but should not have to do this. Summarize what the figure represents, beyond the details: High flows deepen the channel and expose large bed materials while during low flows the channel fills with finer sediments? You do this in the next paragraph for Fig 4.2. Summarize the overall pattern for both. **RESPONSE:** *Language has been edited. Runoff periods have been noted on Figures 4.2 and 4.3.*

4-18--4-20. Is all this gory detail really needed? I believe the objective is to define what the timing, duration, frequency and magnitude of discharges are needed to construct and maintain cobble bars. I know this is a complex subject and the recommendations are preliminary because of only a few years of data. However, I suggest just referencing the approach used, provide the methodological details elsewhere, and focus on the relevant results given on pgs 4-21--4-22. The reader was spared the details of how squawfish spawning dates were estimated on Fig 3.1, a similar level of abstraction should hold for the hydrologic and geomorphic sections. **RESPONSE:** *Much of this detail was added in response to earlier comments relating to the foundation for the flow recommendation. The imbalance that resulted between the level of detail in geomorphology and biology sections is justified by the heavy weight of the hydrology/geomorphology relationships in the development of the flow recommendation.*

4-34--4-37. These figures present a good evaluation of how flow events affect backwater "productivity". In order to examine the relative importance of resources in backwater habitats to age 0 fishes it would have been valuable to contrast them with other potential nursery habitats. Without information on relative differences in periphyton, detritus and invertebrates between backwaters and other locations how do I know whether the amounts of these indicators you report in Figs 4.11-4.13 are high or low? **RESPONSE:** *We agree that additional habitat quality data would have been nice to have, but this area of study was not a major emphasis during the 7-year research period.*

4-44. How habitat complexity was determined is vague. Either provide a reference or define the size of "contact area" so the reader can better understand what habitat complexity is. Better yet, show on Fig 4.15 an example of how habitat complexity is determined by drawing circles of contact areas. See remarks on Table 4.15 and Figure 4.15. These need additional clarification in their

captions. **RESPONSE:** *We have added additional sentences to clarify how habitat complexity was determined.*

4-44--4-48. While the results of the squawfish radiotagging are provocative the sample size (9 wild fish total) is quite small compared with 56 stocked razorback suckers. I suggest a caveat be inserted acknowledging the small sample size, but that the fish were wild and they are rare. **RESPONSE:** *While sample size is acknowledged on p. 4-42, since the results fit so well with habitat use in other areas we see little reason to suggest it may not be accurate due to small sample size.*

4-51. Low winter flows presumably were the "natural " condition, so it is not surprising that they had, "no observable detrimental effect" on razorback suckers. Perhaps a more relevant question is do post-dam higher winter flows show a "detrimental" effect or not? **RESPONSE:** *We agree but the test was of a low winter flow that was proposed primarily to conserve water rather than provide something for the native fish. The effect of high winter flows may become more obvious if future flow management includes extended low winter flow periods.*

4-53--4-72. Other native Fish (should be Fishes). This section could benefit from some serious editing. There is a lot of data, but its unclear what the objectives were. This yields a rambling section where lots of information is related with little attention directed to causal factors. Showing a negative relation between CPUE and discharge could just as easily tell us that you are less effective at catching fish at high flows (I know we are) or that they move to different habitats, rather than high flows somehow reduce fish numbers. Relating condition to river flow is also a suspect analysis. A fishes condition at any instant is the integration of numerous factors that occurred **prior** to the instant and should be minimally affected by flow on the date you caught it. For example, typically condition increases from fall to spring if females developing gonads are included in the analysis. There are many such instances of over-generalization and speculation (e.g., relating high discharge to reduced productivity and decreased flannel mouth condition as well as the converse) without any direct causal evidence. I suggest shortening this section by looking at the main conclusions for each and revising the preceding material to delete that which does not directly relate to these points. For example, report the pertinent info showing the decline in YOY flannelmouth suckers catch rates over the study. However, to do this you need to have replicate samples from similar habitats, collected using the same gears and effort, at the same season over multiple years. This information needs to then be tested for a significant decline with time, etc. Additionally, if population size were decreasing over seven years this might be reflected in a shift in size classes (Fig 4.17), i.e., lack of recruitment. Does Fig 4.17 suggest such a trend? **RESPONSE:** *We agree that these sections may be long, but that is one result of multiple authors of a document such as this. We have left the information intact since it was important to show that these types of tests were made. The conclusions drawn were generally not clear. Since these fish were not the focus of the 7-year research effort, sampling was not designed to clearly show what was happening to their populations. Although not a focus of future monitoring, the Long-term Monitoring Plan is addressing sampling of other native fishes in the main channel.*

Non-native Species

4-82. It's stated that "Presumably,..." temperatures increased earlier and remained optimal longer in 1996. Why is this a presumption when you have temperature data for multiple years? Examine temperature/flow trends among years and determine if this supposition is valid before making conclusions about how spawning patterns were affected. **RESPONSE:** *We agree and have corrected this sentence.*

4-85. Negative correlations between red shiner density and flow could be causal as suggested or partially a consequence of decreased sampling efficiency as indicated on pg 4-47 for other non-natives. This should be acknowledged. **RESPONSE:** *As noted on p. 4-82, this analysis does not include all data but only that collected by NMGF in secondary channels, which were more consistent between years. But flow level may have been a factor in the correlations.*

What impact would an August low temperature spike of >3000 cfs have on native fishes? Is such a spike part of the "natural hydrograph" that is considered so important. It's somewhat contradictory, and perhaps self-defeating, to stress a natural hydrograph as the critical management tool for restoring native fishes and then suggest modified flow/temperature pulses to control non-natives without first rigorously evaluating their effects on YOY razorbacks and squawfish. Fortunately, on pg 6-6 the potential impacts of artificial flow pulses on natives fishes are acknowledged. **RESPONSE:** *Many members of the Biology Committee agree with your overall comment. A detailed study of the effect of natural flow spikes on red shiner numbers is presently being conducted to help clarify this situation and the monitoring program should allow an evaluation of the effect of flow spikes on young endangered fishes, once they become common in the system.*

Chapter 8

8-1. Somewhere in this document I think it would be valuable to give the reader a brief summary of the adaptive management program presented in Section 5.7 of the LRP. It is one of the keystones of your Program and not everyone (like me) will be familiar with it. **RESPONSE:** *Adaptive management is discussed more on p. 1-5, but it has not been developed in detail yet by the Program. A more detailed explanation will be developed for the Synthesis Report where other milestones, such as adaptive management, will be discussed in detail.*

8-6. Explain the differences between "minimum releases" and "primary releases" before detailing on page 8-7. Also, it would be helpful to remind the reader of the terms used in Chap 8 Figures and Tables. For example is "baseline" flow explained? What is "Current" and how does it differ from Study Period"? These should be generic definitions and referenced to Table 7.3. To those who are steeped in the Project these terms are probably obvious, but many of your readers might be more like me and need some repetition. This is the critical Chapter of the Report,; it must be explicit even if a bit redundant. **RESPONSE:** *We have added a paragraph to help clarify the various types of peak flow. The term "baseline" has been replaced by "depletion base" and it, as well as "current", are well defined in Chapter 7.*

Words to Consider Adding to Glossary

General: Very few of the technical hydrological terms used throughout the text are defined in the Glossary relative to biological terms.

"Nose" Table 4.9, pg. 8-7 **RESPONSE:** *We have replaced the use of this word in the text with "early release." The following words have been added to the Glossary along with other hydrological terms.*

Roughness (Manning's n)

Habitat complexity (pg. 4-44)

Ramp up and ramp down (used throughout, but never defined)

Minimum peak release (pg. 8-7)

Primary peak release (pg. 8-7)

Depletion base condition

Tables

S1 and 6.1. That is the most important Table of the Report and must therefore be explicitly clear.

Change: Adult Colorado squawfish and razorback sucker ~~prefer~~ use complex river areas. Preference requires demonstration that fish use exceeds availability of a particular area within the system. Text doesn't indicate preference was determined.

Flow Requirement.

Number of spring runoff... (2 boxes).These sentences are unclear. What number of days?

Temperature flow requirement. This box should tell what is needed for fish, not what is wrong. **RESPONSE:** *Your proposed changes to Tables S.1 and 6.1 have been made except that related to temperature. Due to the location of intakes on Navajo Dam, the water cannot be warmed up to meet historical temperatures but releases still provide sufficient temperature for the endangered fishes to spawn.*

2.1. Why are there so many blanks for various terms? They should all be defined, no matter how obvious (e.g. island) they may seem to us. Define "pocket water". Define "cutback", see next comment. **RESPONSE:** *This table has been revised to include definitions for all habitats.*

2.2. Stream channel contact. What's a "cutback"? Its not listed or defined in Table 2.1. **RESPONSE:** *This was a typographical error. The term is "cutbank", denoting an unstable, eroding bank, often with overhanging vegetation. Category has been changed to "eroding bank."*

4.15. and 4.16. Explain what selection is here., i.e. >0 and how a number like 30 relates to 10 , etc. All values of habitat selection should be reported, not just positive numbers. For example, in the text you say that run habitat was the most used in Feb 1994, but eddies were the most selected. There is no number for runs in the Table, so how do I know if they were selected for or against? If habitat selection is a mean, say so, and give the number of fishes sampled to derive the mean The Table should be self-explanatory, now its somewhat vague. **RESPONSE:** *We have added additional language to clarify these tables.*

4.18. You need to be careful interpreting significance within such massive correlation tables such as this. The 9x15 matrix yields 135 potential values, 6.75 of which will be significant by chance at the $p<0.05$ level (i.e., 5% of 135). There are 6 reported values in the Table that were significant. There are statistical approaches to adjust the p level for multiple comparisons (e.g., Bonferoni correction). I suggest consulting with a statistician before interpreting the results from this Table. **RESPONSE:** *You have misinterpreted the table. Each box is a single comparison rather than multiple comparisons.*

5.1. The text indicates that variability of data were high, but this Table only reports mean values. It would be informative to include some estimate of variability (e.g., SD, SE) so the reader can determine how high it actually was. **RESPONSE:** *Extremes are also included for the base flow period. Standard deviations have been added.*

8.7. Tell in a footnote what "Average Perturbation" means. **RESPONSE:** *Explanation has been added.*

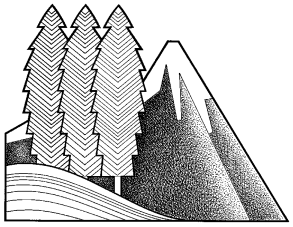
Figures

2.6. Making this in color like previous Figures would make it easier to read and enable you to delete the symbols which add clutter. **RESPONSE:** *We agree and have made it in color.*

4.1. Nice figure, but it's not immediately clear from the caption that the horizontal substrate bars match the channel x-section above them. Explain a bit better in the caption what the figure illustrates. **RESPONSE:** *The explanation has been added in the caption.*

4.15. Tell the reader what all the numbers in this figure represent (e.g., specific habitat types). Better yet, number the habitats in Table 2.1 to match these so the reader can refer back to them. **RESPONSE:** *We have added language to make the figure more understandable.*

8.3-8.10. The legend and figures don't exactly match. There is an ellipse symbol in the Figs that isn't in the legend, unless it is a typo in "Current". Also, Baseline + 59000 and Baseline + 122000 have the same symbols. **RESPONSE:** *The large ellipse denotes the "primary criteria" for flow/duration/frequency. It has been added to the legend and the other corrections made.*



Dr. RONALD J. RYEL
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North Logan, Utah 84341-1906
Phone: 435-753-6077
Fax: 800-446-0357

December 11, 1998

Dr. Paul Holden,
Bio/West, Inc.
1063 West 1400 North
Logan, UT 84321

Dear Paul,

Attached are my comments on the draft report: "Flow Recommendations for the San Juan River", dated 16-September-1998. I have tried to keep my comments general, but have indicated a few specific points.

I apologize for not being able to attend the Biology Committee meeting, December 14-15, 1998. I would have enjoyed discussing these and other points with members of the committee. I would also have liked to participate in discussions concerning the monitoring plan. Perhaps in the future, the Biology Committee should inquire about the schedules of the review panel members, or schedule their meetings further in advance. I would like to thank the Biology Committee for allowing me to review this report.

Sincerely,

Ronald Ryel

Comments on draft report: "Flow Recommendations for the San Juan River", dated 16-September-1998. Dr. Ronald J. Ryel

(1) The Biology Committee is to be commended for producing a much improved document. Many of the comments provided by reviewers have been incorporated which show a receptiveness of the committee to outside review. The document is much easier to follow, and the objectives, logic, and data analyses are much more clearly presented. The document is not perfect, but it is getting much closer to a final form. The Executive Summary is quite well done and readable.

(2) The document can still use some final editing to address the following (and perhaps more): a) missing definitions in Table 2.1 (e.g., pocket water); b) missing units (e.g., p. 2-4, sediment loads in last paragraph); c) difficult to read graphs (e.g., Fig. 2.6); d) problems with number alignment in tables (e.g., Table 2-27, column of D50, mean and line of Feb. 96); e) lack of site reference for biological data (e.g., p 3-20, first sentence of first full paragraph–"...were commonly found in ..." [where was this found?]); poor sentence structure (e.g., p 6-3, last full paragraph, second to last sentence: "... these habitats appear to have lower survival compared ..." [habitats do not have survival rates]). A very careful reading by 2 editors could catch many of these things. Also the literature cited should be checked with the list in the back if this has not been done. **RESPONSE:** *We have made most of the changes you have suggested and many had been made in the last draft.*

(3) The document should be checked again for statements with missing citations. Two examples are: p 2-26, last sentence of second to last full paragraph: "Cobble substrates are typically more productive than sand substrates, and more embeddedness generally is related to poorer biological productivity"; and p 3-7, first sentence of first paragraph under Eggs: "It is assumed that eggs are deposited in cobbles and gravels within riffles and chutes during spawning events" [assumed by whom?]. It is important to provide citations for such statements as these are carried on as important concepts in developing flows. **RESPONSE:** *Some of the statements that may not have citations are the conclusions of the Biology Committee in this report, and hence, do not have other citations.*

(4) A reasonably good 'first cut' of statistical analyses were performed to evaluate the biological relationships to flows and the test flow period. Certainly more could be done (and should be done), but it appears from these analyses that few really convincing relationships could be found in the data. Further analyses may find a few more, but I don't feel that would significantly change the hypothesized relationships shown in Fig. 6-1. If this table represents the state of knowledge about these fish, then it provides the best basis for the flow model (as opposed to relying heavily on site specific data analyses). Concurrence of these relationships of the fisheries experts on the Biology Committee (and perhaps others) is thus important since the flow recommendations are based on these perceived habitat needs. I feel that since these relationships and those assumed for non-native fishes provide the basis for the flow recommendations, these need to be the common ground of assumptions of how to improve the system for the fish. Justification for the flow model and recommendations becomes the relationships in Table 6.1 (and others for non-natives and perhaps for other trophic levels), and not simply the statistical strength of measured relationships within the

river. It is important that everyone understand this concept. **RESPONSE:** *Most of the Biology Committee members understand this premise.*

(5) I definitely do not like the use of the term "Flow Requirement" as a column heading in Tables S.1 and 6.1 (same table). First, it is not a flow "requirement" that resulted in the decline of flannelmouth suckers. The decline may have coincided with the return to a more natural hydrograph, but this action does not require such an event. Also, the term "requirement" is a bit strong for many of the hypothesized relationships between the biology and habitat, as the same habitat characteristic may result with different flows characteristics. I suggest changing the heading to "Flow Characteristic". This works consistently for "Biological Responses" and "Habitat Requirements", and is a better description of what is being stated. **RESPONSE:** *We agree and have made this change.*

The following are some additional minor comments:

(6) Error bars should be included on many figures (e.g., 4-10, 4-11, 4-12, 4-13). **RESPONSE:** *Your comment is noted and we have edited some figures, specifically the ones you mention, to include indication of the error involved.*

(7) On page 6-6, last sentence under section, "Relationship between flow and nonnative species" states that "Summer spikes designed to suppress red shiner would detract from mimicry of a natural hydrograph...". What about summer thunderstorm-induced high flow spikes? These may not occur on an annual basis, but surely they occur in July-September (see Table 2.3). **RESPONSE:** *Natural summer flow spikes do not detract from a natural hydrograph, but man-made spikes may both in timing and temperature.*

(8) In Chapter 2, habitat versus flow is only expressed as percent of the total. It would be nice to see the data presented as total wetted area as well. It is difficult to determine the amount of habitat really available. Perhaps only a list of the TWA is needed for each flow and the reader can calculate the actual areas using the percentages. **RESPONSE:** *Total wetted area has been added to figures 2.7 and 2.8.*

(9) Results of contaminant study were listed for YOY razorbacks, but not Colorado squawfish. They should be listed for CS as well. **RESPONSE:** *See page 5-4. Toxicity studies for both species are listed.*

(10) In introduction to other native fishes, it would be nice to list all the native species in the river (both past and present) and perhaps all the nonnatives in the same table. **RESPONSE:** *We are not sure where this would go and the discussion in chapters 3 and 4 clearly define the native fish, especially the introduction to Other Native Fishes in Chapter 3.*

(11) In Table 4.5, the multiple R^2 results could be left out. They are likely not significant due to the high degree of correlation between the flow variable. I imagine the condition number for these regressions are very high resulting in invalid regressions. **RESPONSE:** *We agree that the correlations are not significant, but disagree that they are invalid. The condition numbers are not so high as to invalidate the regressions and they are not as auto-correlated as you may think. The significance is discussed in the text. It is clear that little, if any, weight can be given to the relationships in terms of quantification, but we believe that the general conclusion that cobble movement increases with increased volume and duration of runoff is indicated, although not quantified.*

(12) This regards the sparse YOY data for CS (p 4-40). We have discussed this before and I am not entirely comfortable with the perceived relationship between flows and numbers collected. However, I would suggest that you change the first sentence of the last paragraph ("The general trend in the collections, when considering absolute catch ...") to: "Higher collections coincided with years with higher flows. If such a relationship is valid, then higher flow years (...) may have been better reproduction years than low flow years (...). **RESPONSE:** *This has been changed as of the December 4, 1998 draft to be similar to your comments.*

(13) Page 4-60, top of page: I do not follow the logic behind: "This indicated that even given the apparent negative influence of flow on flannelmouth sucker CPUE, juvenile and adult CPUE still appeared to decline over the study period". This needs further explanation. **RESPONSE:** *We have added more language to clarify this statement..*

(14) Could the decline in flannelmouth suckers over the course of the study flow period be due to reduced base flow and TWA? Reduced base flows would reduce the total habitat area of the river and would likely result in lower numbers of the most common fish (which inhabits many of the habitats). The increasing condition factor over the course of the study could correspond to the population coming into equilibrium at a lowered carrying capacity. **RESPONSE:** *This hypothesis may be reasonable although numbers of suckers are highest in upper, smaller portions of the river, suggesting TWA is not a major factor in this relationship..*

(15) If flannelmouth suckers declined in numbers and blueheads increase, is the total biomass similar or decreasing? This could affect CS carrying capacity. **RESPONSE:** *Total biomass appears fairly similar. As noted in several locations in the report, flannelmouth sucker remain the most abundant large-bodied fish in the river.*

DEPARTMENT OF ZOOLOGY
THE UNIVERSITY OF TEXAS AT AUSTIN

Austin, Texas 78712-1064

8 December 1998

Paul Holden
1063 West 1400 North
Logan, UT 84321

Dear Paul:

I received the San Juan River Flow Report. I have no substantial problems with this version. The major problem would be to ascertain the effects of varying peak flows. Is 6000 cfs better (or worse) than 5000 cfs? That is now predicted, but needs to be grounded in truth, i.e., try it and see what occurs.

I think some reference to GCES might help with the background materials. Two books come out of that exercise.

I note one minor problem. Tyus 1990 and 1987 have the same volume and page numbers. I know Harold has lots of skills, but two papers in the same issue on the same pages stretches the imagination.

Sincerely,

Clark Hubbs
The Clark Hubbs Regents Professor Emeritus
The 1998 Texas Academy of Sciences Distinguished Scientist

CH/dm
Enclosures

January 14, 1999

VIA TELEFAX AND FIRST-CLASS MAIL

Ron Bliesner, Chair
Biology Committee
San Juan River Basin Recovery Implementation Program 78 East Center
Logan, Utah 84321-4619

Dear Mr. Bliesner:

The New Mexico Interstate Stream Commission, on behalf of the State of New Mexico, submits for consideration the following comments on the Flow Recommendations for the San Juan River, Draft Report, prepared by the San Juan River Basin Recovery Implementation Program's Biology Committee and dated December 4, 1998. The flow recommendations themselves were adopted by the Program's Coordination Committee at its October 15, 1998, meeting. Pursuant to the deliberations of the Coordination Committee at its December 15, 1998, meeting, these comments are limited to the draft report's treatment of technical issues relating to the determination of the recommendations of flows to provide for habitat for endangered fish in the San Juan River. The Commission also has many concerns regarding application and implementation of the flow recommendations, including future modifications to the flow recommendations. The Commission reserves these concerns for future discussion with Implementation Program participants (see my August 20, 1998, and November 2. 1998, letters to Joseph Dowhan).

Page 2-2, last incomplete paragraph. The flow recommendations assume that San Juan River flows alone can and should be used to maintain the river channel and channel complexity needed to provide for endangered fish habitat. However, the draft report indicates that changes in watershed conditions in the San Juan River Basin and changes in river channel vegetation, along with changes in flow regimes in the river, have caused substantial changes to the river channel. The report should discuss the possibility of maintaining the river channel for fish habitat using vegetation control in the river channel and floodplain, watershed management measures that would reduce sediment loading to the river channel, and physical river channel modifications. Implementation of such actions might reduce the amount of streamflow needed to maintain adequate fish habitat in the San Juan River. The minutes of the February 25, 1998, meeting of the Coordination Committee indicate that flow management to attain recovery of endangered fish populations in the river was to be reviewed in consideration of non-flow recovery actions that could be implemented within the basin (see third page, first non-indented paragraph). The report should discuss how this review was or will be conducted. **RESPONSE:** *Both of the actions you suggest have been considered. Removal of non-native vegetation, primarily tamarisk and Russian olive, would help restore the flood plain to early 1950's condition. It is not known what effect this would have on the present channel dynamics or flow requirement. It could require more or less flow than the present recommendation. An*

extensive research program would be required to determine (1) if it is possible, and (2) what the effects would be. Watershed management to reduce sediment load would make storm perturbation less of a problem and would likely reduce flow requirement for habitat maintenance. It has merit, but is vast in scope and cost considering the size of the basin and the magnitude of the problem. Both are future possibilities that should be discussed in terms of future actions that can be taken, but have no bearing on the present flow recommendation. They would be a part of adaptive management.

Page 2-4, first complete paragraph, and page 2-15, first complete paragraph. The San Juan River and its channel were modified from its natural form for decades prior to construction of Glen Canyon and Navajo dams in the early 1960s. The report should discuss the history of declines in populations of the endangered fish in the river. If the fish populations were in decline under pre-dam conditions due to deteriorated watershed conditions affecting fish habitat, then watershed management measures should be evaluated as possible contributors to enhancing recovery of the populations. If the fish populations were stable under pre-dam conditions when flows below 50-100 cfs were not uncommon, then the report should discuss why the target base flow criterion for the summer through winter months of 500 cfs is not reduced to take into account observed biological responses. **RESPONSE:** *See page 3-2, second paragraph for a discussion on the Colorado pikeminnow. Very little is known of the historic abundance of razorback sucker in the San Juan River, other than anecdotal accounts. Declines for some of the species may have started prior to the large dams since smaller tributary dams and mainstem depletions occurred since the 1800s. Watershed deterioration may have been a factor in pre-large dam population decline, but the major declines in the native fish occurred following large dam construction. Hence, it is not clear if watershed enhancement would improve conditions sufficiently to see an improvement in native fish numbers. The irrigation depletions that occurred pre-large dams are primarily responsible for depressing the flows to the levels you list. The 500 cfs used represents the low 8% flow for natural, non-depleted conditions and the approximate median flow for pre-dam historical conditions. Given the channel conditions and other man-made influences (e.g. contaminants), the Biology Committee was not comfortable with base flows below 500 cfs.*

Page 2-10, second paragraph, second sentence, and page 2-26, first complete paragraph. The flow recommendations include criteria based on the amount, duration and frequency of flow considered necessary to clean backwaters and maintain low-velocity habitat in secondary channels in reach 3. However, it is not clear that meeting these criteria with releases from Navajo Reservoir would be an effective use of the water supply because the beneficial effect of the spring releases on fish habitat in reach 3 is extremely vulnerable to being negated by perturbations to the fish habitat in the reach which occur due to runoff from summer and fall storms. The draft report at page 4-37, second complete paragraph, states that storm events, not spring runoff conditions, appear to be the dominant factor regulating backwater and other low-velocity habitat quality and productivity. The report should present data or information indicating how often backwaters are perturbated by summer storms and how often such perturbations render backwater habitat unsuitable for larval and young-of--year Colorado squawfish. Again, the report should discuss the possibility of maintaining the river

channel for fish habitat using measures other than large amounts of streamflow. **RESPONSE:** *As evidenced by use of backwaters by stocked YOY Colorado pikeminnow, even after storm perturbation, the backwaters do not become unusable. While productivity of backwaters is most strongly related to perturbating storm events, abundance of backwaters is heavily influenced by the runoff hydrograph. No non-flow related action has been identified to maintain backwater habitat and its effect quantified to be considered in making the flow recommendation.*

Also, the flow/backwater habitat area relationships given in the draft report at figures 7.2 and 7.3 suggest that if the criteria for full cleaning of backwaters in reach 3 is not met, there still would be backwater habitat in reach 3 as well as in other reaches of the river. The report should discuss why the amount and quality of backwater habitat in the San Juan River would be sufficient under the conditions where reach 3 is fully-flushed but insufficient under non-flushed or less than fully-flushed conditions. Further, most of the larval and young-of-year squawfish that have been found in the San Juan River were caught outside of reach 3. The report should discuss the flow rates and frequencies required to maintain backwaters in reaches other than reach 3. The report also should discuss whether near-annual maintenance to a near-optimal condition of backwaters in reach 3 through the use of spring runoff flows is both appropriate in light of the possibility of habitat perturbations soon following the spawning season and critical to recovery of squawfish because the fish use backwaters in other reaches as well as different habitats. The draft report at page 4-48 indicates that young-of-year and juvenile squawfish can use low-velocity habitats other than backwaters. Accordingly, it is not clear why full flushing of backwaters in all reaches is necessary to provide adequate nursery habitat for squawfish. The report should discuss why less flushing action with a flow rate and duration of less than 5,000 cfs and 21 days, respectively, and less flushing frequency with a frequency less than 50 percent of the years would not provide adequate nursery habitat for the endangered fish. **RESPONSE:** *The flushing frequency is based on the best judgement of the researchers based on the seven years of data available. Given the status of the fish, to make a flow recommendation that would provide less backwater habitat than existed in the system pre-dam would be irresponsible, especially when considering we can maximize nursery habitat in only about one half their former range. The recommendation predicts that the backwater habitat conditions, in terms of abundance will be about the same as they were for the same reaches pre-dam (See Tables 8-7 and 8-8).*

In addition, removal of, or construction of passages around, barriers to fish movement between Cudei and Farmington would allow endangered fish to have improved access to potential spawning and rearing habitat further upstream in the San Juan River, which might lessen the need to try to maintain temporary or questionable quality rearing habitat in reach 3. Any losses in backwater habitat in reach 3 might be offset by creating more access to backwater habitat in reach 5 via opening up access to possible spawning habitat in reach 6 above Shiprock (see page 8-24, third paragraph). The report should discuss how this was considered in the determination of flow recommendations. **RESPONSE:** *The recommendations were made assuming that such barrier removal would occur. The flow recommendations were made to maximize all potential nursery habitat in all reaches since only about one half of the former range is available to the fish. About 50 miles of habitat has been*

lost by Navajo Reservoir and the cool tailwater, and another 77 miles of habitat is under Lake Powell. To suggest at this stage that the fish will not need nursery habitat in Reach 3 is not supported by any data we have, especially since we have found stocked Colorado pikeminnow using this area.

Page 2-14, last sentence. This sentence should be revised to clearly state that sequential years may have an annual discharge of less than 1,000,000 acre-feet each year. **RESPONSE:** *The sentence has been changed.*

Page 4-14, last incomplete paragraph. The flow recommendations include criteria based on the amount, duration and frequency of bankfull flow, which is assumed to be adequate for channel and spawning bar maintenance. Flows above bankfull spread onto the floodplain and do not add substantial energy for transporting cobble or forming cobble bars.

Habitat mapping data for 1993-1994 for reaches 3, 4 and 5 covering a river length of 86 miles, inclusive, downstream of the Hogback diversion suggests that bankfull flow for the San Juan River generally is in the range of 6,500 cfs to 7,700 cfs (see page 4-9, last paragraph, and page 4-13, first paragraph). However, a hydraulic computer model (HEC-RAS) predicted that bankfull flow for the river generally is in the range of 7,100 cfs to 10,500 cfs, and averages about 8,000 cfs, for four stretches of the river of only 0.25-mile length (see page 4-15, last paragraph). Of the four stretches modeled, one was in reach 5 upstream from the Mixer spawning area and three were in reach 6 above the Hogback diversion. In addition, bankfull flow calculations were made using the Manning equation for eleven river transacts measured in 1992 and 1997 at unspecified locations in reaches 3 through 6 (see page 4-14, first paragraph, and page 4-5, first complete paragraph). The Manning equation calculations predicted that the average bankfull flow for the eleven locations was 7,300 cfs in 1992 and 8,200 cfs in 1997, with bankfull flow at individual transect locations ranging from 5,300 cfs to 12,600 cfs.

Given the location of spawning sites and rearing habitats for endangered fish in the San Juan River, it is not clear that the bankfull flow estimate indicated by the habitat mapping field data for reaches 3-5 inclusive should be set aside on the basis of hydraulic models or calculations for small portions of the river. The report should discuss why it was appropriate to give more weight to the hydraulic modeling and Manning equation calculations, both of which contain uncertainties in data and assumptions, than to the habitat field data for estimating a bankfull flow for the river. The report also should discuss whether the modeling is sufficiently calibrated to support this flow recommendation. In addition, the report should discuss why flow rates less than 8,000 cfs could not provide bankfull flow or cobble bars along sufficient stretches of the San Juan River to provide adequate habitat and spawning sites for the endangered fish. **RESPONSE:** *For cobble bar maintenance, Reaches 5 and 6 are the most critical because they cover the area where spawning needs to occur for reasonable drift opportunity. Therefore, the modeled reaches are correctly located for the purpose of critical cobble bar maintenance. Actually the three data sets, habitat, modeling and Manning equation calculations for cross-sections, all support each other. The*

modeling and later Manning estimates agree and the habitat mapping and early Manning estimates agree. The cross-section measurement clearly indicate an increase in channel cross-sectional area which equates to increased channel capacity. Further, if a lower number for channel capacity would have been used, the frequency and duration conditions would have been greater to accomplish the objectives since the frequency and duration were established based on an analysis of post-dam channel response to flows compared to the research period. It is likely that the flow recommendation overall may not have been much different. The results of monitoring and adaptive management will allow for any necessary adjustments to these recommendations.

Page 4-18, first paragraph. The flow recommendations include criteria based on the amount, duration and frequency of flow considered necessary to produce clean cobble and resculpt bars for spawning. The available data indicates that sufficient cobble movement to resculpt bars occurs at 2,500 cfs. However, the threshold minimum flow rate actually needed to move cobble for cleaning and reshaping bars might be significantly less than 2,500 cfs. The report should discuss the threshold minimum flow rate needed for cobble movement on bars or how this threshold flow rate can be determined. **RESPONSE:** *As noted in the paragraph you reference, we have no data to assess the effectiveness of flows less than 2,500 cfs. Further, flows lower than this may be ineffective in terms of hydrograph shape to cue spawning.*

Page 4-22, first incomplete paragraph. The flow recommendations include criteria for the duration and frequency of flow greater than 10,000 cfs. Periodic flows above 10,000 cfs below Farmington are recommended for maintaining channel complexity and providing new cobble sources. Lesser flow for a duration of less than 5 days may perform this function adequately. The recommendations that flow of 10,000 cfs for 5 days be provided in 20 percent of the years are only inferred from data on island counts during the research period. Yet, the draft report recognizes that five years of island count data are not sufficient for evaluating long-term trends or flow needs for maintaining channel complexity (see page 4-12, last two sentences). The report should discuss why less flow for less duration less frequently would not provide sufficient channel complexity and fish habitat in the San Juan River. **RESPONSE:** *10,000 cfs is recommended first as restoration of the most modified portion of the natural hydrograph and is verified based on the island count data. Future monitoring and adaptive management will assess the effectiveness of this recommendation and whether it needs to be adjusted up or down.*

Page 4-22, first complete paragraph. The report should discuss how often the pre-Navajo Dam channel capacity was exceeded during the pre-dam period so that such information could be compared to the frequency criterion for the flow recommendation for the occurrence of bankfull flow. Primary criteria for flow recommendations are based on current geomorphology and secondary criteria are based on modeled flow statistics, both of which may not give pre-dam geomorphology or the desired habitat. Also, the frequency criterion for flow above 8,000 cfs considered the frequency of bankfull flow needed to prevent loss in channel capacity. Specifically, the frequency of bankfull flow needed to maintain channel capacity is assumed based on channel capacity changes during the research period at selected cross-sections located primarily in reaches 5 and 6 (see page

4-21, last incomplete paragraph). It should be noted that the river transect channel data and Manning equation calculations do not illustrate that a significant change in channel capacity occurred during the research period throughout the river as a whole or that small changes in channel capacity at the river transect locations over a period of a few years constitute long-term trends rather than short-term variations (see page 4-8, first complete paragraph). The report should clearly indicate uncertainties and assumptions in the development of the flow recommendations. **RESPONSE:** *The pre-dam channel capacity is not known. The cross-sections measured in 1962 did not include any underwater survey data. The flow recommendation criteria are based on the existing channel configuration. If a desire exists to restore the pre-dam channel, then the flow recommendations would have to be larger. Both pre- and post-dam hydrographs were considered in making duration and frequency recommendations (Page 4-21, last paragraph, 4-22, second paragraph). The cross-section data do indicate that there has been a system wide increase in channel capacity, but do not indicate whether this is a long or short term response. Similar changes likely occurred during wet periods, even post-dam. Nearly every flow-response result includes the caveat you suggest, in addition to numerous references to adaptive management and the need to periodically evaluate the recommendations.*

Page 4-40, last incomplete paragraph, first sentence; page 4-41, first complete paragraph, first five sentences; and page 6-1, last paragraph. There were so few Colorado squawfish collected in the San Juan River during the 1987-1996 period that it is not clear how any conclusions can be drawn relating spawning success to spring runoff. There simply are very few fish in the river. Of the thirteen young-of-year and juvenile wild squawfish captured in 1993, eleven were collected in an area sampled only in 1992, 1993 and 1994 (see page 4-40, last complete paragraph, fourth sentence). In addition, two of the squawfish captured in 1993, two of the seven squawfish captured in 1995, and one of the two squawfish captured in 1996 were larvae caught in larval drift nets, a sampling technique apparently not employed until at least 1991 (see page 4-40, first paragraph, first four sentences). The sampling efforts during the years 1991-1995 far exceeded the efforts made during the years 1988-1990 (see page 4-41, table 4.14). Consequently, it is difficult to conclude from the extremely few fish collected using inconsistent sampling protocol that spawning success is significantly and positively correlated to spring runoff volume. This remains an unproven hypothesis due to a lack of fish with which to measure any spawning response to spring flows. The report so indicates at page 4-41, first complete paragraph, first sentence. This should be so clarified elsewhere in the report where biological response of squawfish to research flows is suggested or discussed. **RESPONSE:** *This section has undergone considerable change as the Biology Committee has investigated this information. It is the consensus of the Biology Committee that the way this information is presented is accurate. The fact that it fits with what has been learned in other Upper Basin rivers lends credence to the conclusions in the San Juan Basin.*

Page 4-68, first complete paragraph. The report concludes that flow of 8,000 cfs for 8 days is adequate for constructing cobble bars, but the duration criterion for flow of 8,000 cfs was adjusted to 10 days based on a perceived positive response of bluehead sucker spawning to high spring runoff (see page 8-4, category B). The draft report presents no actual data for captures of larvae or young-of-year bluehead sucker to support its conclusion regarding a relationship between bluehead sucker

spawning success and spring runoff flows. However, the draft report presents data indicating increasing catch rates with time from 1993 to 1997 for bluehead sucker for reach 6 only, but lower catch rates for reaches 1-5 inclusive for both juvenile and adult bluehead sucker for the years 1994-1997 as compared to the years 1991-1993 (see page 4-66, figure 4.25, and page 4-58, figure 4.18). Juvenile bluehead sucker may range in age from 2 to 4 years. The report should describe the absolute numbers of juvenile and adult bluehead sucker collected in the different river segments, along with problems in sampling protocol, so as to demonstrate any perceived trend in reproductive success for the population as a whole in response to test spring flows. The report acknowledges that the attribute of runoff to which bluehead sucker responds is unknown. **RESPONSE:** *Table 4.19 is an analysis of young-of-the-year catch data, hence it reflects reproduction success.*

Further, fish collection data for flannelmouth sucker were not consistent with and did not exhibit the same trends as collection data for bluehead sucker. It is not clear that the data are of sufficient quantity and quality to determine that 2 days additional duration is critical to maintaining the populations of native fish species in the San Juan River, particularly endangered fish populations. Nor is it clear that the endangered fish and non-endangered native fish have need of the same flow regimes because they have a different population status in the river and apparently responded differently to past flow regimes, including test spring flows during the research period. The report should discuss more thoroughly why the duration criterion for flow of 8,000 cfs was extended from 8 days to 10 days to presumably accommodate some of the non-endangered fish when the extended criterion has not been shown to be needed to meet the Implementation Program's goal of recovery of endangered fish. **RESPONSE:** *A basic tenant of the SJRIP has been that the native fish community was of concern, not only the two endangered fishes. The Biology Committee believes that changes in the density of non-endangered native fish reflect on environmental factors important to the endangered species. For example, young bluehead sucker may be a major food source for juvenile and adult Colorado pikeminnow so maintaining bluehead sucker populations is an important aspect of the SJRIP.*

Pages 7-10 through 7-16, section entitled "RiverWare Model of the San Juan River." This section discusses features of the RiverWare model for the San Juan River Basin. Although New Mexico has had some input to the development of the RiverWare model for the basin, it must be made clear in the report that the Bureau of Reclamation and Bureau of Indian Affairs developed the model and that the Bureau of Indian Affairs made model application decisions as described in the report for consideration by the Biology Committee. New Mexico still has concerns with the use of the model as it is currently formulated. New Mexico does not fully agree that the model input data and assumptions are appropriate.

New Mexico feels that the original Blaney-Criddle method should be used to compute irrigation demands and consumptive uses in the basin consistent with previously adjudicated and permitted rights in New Mexico. It is our understanding, however, that water rights administration in Colorado is based on the use of the modified Blaney-Criddle method. For the modeling effort to move forward with consistency in data assumptions, the Bureau of Reclamation and Bureau of Indian Affairs used

the modified Blaney-Criddle method to calculate irrigation depletions in both states (see page 7-11, third complete paragraph). It was New Mexico's understanding that the model input data and model output generated using this method would be used for the specific modeling purpose of deriving flow recommendations, and that the choice of method did not affect the determination of the flow recommendations. Based on this understanding, New Mexico did not object to this limited use of the modified Blaney-Criddle method; but, it does object to the use of the model input data or the use of this method for any other purposes, including otherwise defining current or future depletions in New Mexico. The report should so state New Mexico's position on this matter. **RESPONSE:** *A footnote has been added to Tables 7.3 and 7.4 indicating that New Mexico does not agree with the method used for computing consumptive use or the depletion values listed.*

The frequency criteria for the flow recommendations given in the draft report are defined largely by matching the frequencies of given flow rates to the frequencies by which those rates occurred prior to 1962 when operation of Navajo Dam commenced. The frequencies of flow using 1929-1993 period hydrology under different operating and depletion scenarios are compared at the Four Comers gage. Flows at Four Comers after 1969 were gaged, but flows at Four Comers prior to 1970 were determined using a constant distribution by reach of the estimated side inflow gains and losses between the Archuleta and Bluff streamflow gages, exclusive of major perennial tributary inflows (see page 7-12, third complete paragraph). Therefore, the variation of flows after 1969 at Four Comers used for the modeling studies is greater than that of flows prior to 1970. The report should discuss how differences in flow determination procedures, data assumptions and gaging inaccuracies affect flow statistics and flow frequency comparisons between periods. **RESPONSE:** *The frequencies were not set to match pre-dam conditions. They would have been much higher (See Tables 8.5 and 8.6). They were compared, not matched. The variation between the two methods of distributing gains and losses for pre- and post-1970 that you reference are not major. The simplifying assumption is that the split between contribution upstream and downstream of Four Corners was the same before 1970 as after. Since the inflow is small and the upstream and downstream conditions have not changed dramatically during this time, the introduced error is also small. We have added a statement in Chapter 7 on the effect of gage, model and data error.*

In addition, the draft report does not describe the assumptions and models used to determine ground-water storage and return flows from the Navajo Indian Irrigation Project, the assumptions used to distribute monthly depletions into quarter-monthly depletions, or the assumptions used to compensate for phreatophyte depletions. For simulating reservoir operations, the draft report does not describe how the inflow forecast error is applied: that is, whether the forecast error results in reservoir operations that are conservative towards reserving water supply for water users or towards releasing water for the endangered fish. The report should describe these items. **RESPONSE:** *Such detail is beyond the scope of this document. It will be discussed in the model documentation.*

Also, for the La Plata River, diversions bypassing the Hesperus gage need to be added to the Hesperus gage records to determine natural flows. Flow of the La Plata River at Hesperus is not indicative of flow of McElmo Creek. Further, it is our understanding that shortages on the La Plata

River were estimated differently than elsewhere in the basin. The report should clarify these items. The report also should clarify the basis for the percentage distribution of gains and losses by reach between Archuleta and Bluff. We suggest that there should be a net loss for the Archuleta to Farmington reach. Also, small depletions on minor ephemeral tributaries far removed from the San Juan River do not deplete river flows. This section of the report should address these issues. **RESPONSE:** *McElmo Creek is problematic for several reasons in the model and the report discusses the need to interpret data from the Four Corners gage rather than the Bluff gage for that reason. See footnote to Tables 7.3 and 7.4 for treatment of off-stream depletions. The added discussion that you suggest is beyond the scope of this report and should be included in the model documentation or documentation of the Bureau natural flow estimates.*

Pages 7-16 through 7-23, section entitled "Parameter Selection and Optimization Process." This section presents various hypothetical water depletion scenarios. The draft report assumes hypothetical water development scenarios for the purpose of illustrating how the modeling might project impacts of different levels of development on flow rate frequencies as related to the primary flow recommendations. However, the modeling results also are used to define the secondary flow recommendation criteria given at page 8-3, table 8.1. 'The report should clearly state that the development scenarios presented in the report are not intended to set the baseline for any future Section 7 consultation or recommend any particular development sequence. **RESPONSE:** *See footnotes on Table 7.3 and 7.4.*

New Mexico does not agree with the depletion figures itemized for different water development scenarios in Tables 7.3 and 7.4, which are used in the RiverWare model. New Mexico previously submitted its data for current and base depletions to the Bureau of Reclamation and Bureau of Indian Affairs for use in the modeling effort. New Mexico's figures include 57,100 acre-feet of depletion for the Animas-La Plata Project, and include a level of depletion historically attained by water uses under existing water rights. Further, it is New Mexico's position that its apportionment of the available water supply is 727,000 acre-feet per year from the Colorado River System above Lee Ferry, including its share of evaporation losses from the Colorado River Storage Project, and that the average annual depletion by the Navajo Indian Irrigation Project will be about 254,000 acre-feet when completed. **RESPONSE:** *We have added a footnote to Tables 7.3 and 7.4 that indicates that New Mexico does not agree to the method of consumptive use calculation nor the resulting depletions. A notation has been added dealing with the 57,100 af depletion for ALP.*

Neither the states nor the Implementation Program participants have agreed to the baseline depletions used in the latest Section 7 consultations for the Animas-La Plata Project or the Navajo Indian Irrigation Project. Also, a portion of the depletions to be made by the Navajo-Gallup Water Supply Project is to be made within the State of Arizona and charged against that state's apportionment of Colorado River System water. In addition, current municipal and industrial water depletions in the New Mexico portion of the basin are understated by the draft report. The discussion in this section of the report should be revised to reflect accurately the input provided by the states and the decisions made by the Bureau of Indian Affairs for its RiverWare modeling. The

report also should discuss whether the determination of flow recommendations and recommended operating rules for Navajo Dam would be different if the RiverWare modeling used different itemized depletion figures. **RESPONSE:** *The numerous caveats in Chapters 7 and 8 adequately cover these issues.*

Page 7-22, first incomplete paragraph, last sentence, and last paragraph, fourth sentence. The US Fish and Wildlife Service has not committed as to how the flow recommendations or other factors will be used in Section 7 consultations. Therefore, a level of future allowable depletions may be dependent on other factors, and the flow recommendations should be viewed as recommendations and not requirements. These sentences should be rewritten accordingly. **RESPONSE:** *The wording you discuss references the general requirement under the Endangered Species Act to meet the requirements of the fish, whatever they may be, to avoid jeopardy. The flows in this report are always referred to as recommendations not requirements. This sentence does not reference the recommendations, but whatever USFWS chooses to determine as the requirements for the fish.*

Page 8-1, last paragraph. This paragraph states that the flow recommendations for the San Juan River are not final and suggests a few conditions under which the flow recommendations may be modified in the future. The Coordination Committee has not yet discussed the implementation of the flow recommendations, including criteria for modifying them. Therefore, the report should not speculate on criteria for modifying flow recommendations. If anything, the report simply should state that the flow recommendations should be re-evaluated as necessary to improve the certainty that implementing flow recommendations will help in the attainment of the goals of the Implementation Program. Also, it should be noted that the participants in the Implementation Program have agreed to participate in the Program only through the year 2007. Consequently, the Implementation Program cannot commit at this time to its reviewing the flow recommendations every five years. The frequency of review is an implementation issue for the Coordination Committee to consider. The subject paragraph should be modified accordingly. **RESPONSE:** *Included in the flow recommendation is a 5-year review and update based on adaptive management. The last sentence has been changed to reflect that the review is a recommendation.*

In addition, is there enough information to conclude or reliably predict that the goal of recovery of endangered fish populations cannot be achieved under a particular level of development given RiverWare modeling results as compared to the flow recommendations? If so, the report should discuss the incremental impacts on the endangered fish habitat and populations of not fully meeting the flow recommendations. The small amount of endangered fish collected during the 1992-1997 period did not show a significant natural increase in endangered fish populations in the San Juan River despite six years of reoperating Navajo Dam to provide a downstream flow regime that mimicked the natural hydrograph and produced flow statistics which exceed the criteria given by the flow recommendations. **RESPONSE:** *It is our best judgment, based on the available data, that the flows recommended will promote recovery. There is obvious uncertainty in this assessment but that has been considered in the recommendation. If future results show that recovery can be achieved with less water or more water, then, through the adaptive management process, the recommendation*

can be modified. We have recognized that other limiting factors besides flow exist in the San Juan River, including population size. The lack of measured response of the existing very small populations of endangered fish is no indication that the recommendation is not valid.

Page 8-2, second paragraph, third sentence. The flow recommendations include criteria for the maximum number of years of non-occurrence of particular flow rate and duration combinations at Four Comers. For these criteria, the flow rate recommendations for fish habitat maintenance are reduced by 3 percent to account for side inflow between Four Comers and Bluff. However, the subject sentence states that this 3 percent reduction is to allow for both gage and modeling error in addition to side inflow. For actual gaged flows, the US Geological Survey rates the streamflow records at these gages as having the following degree of accuracy: 95 percent of the daily discharges are within 10 percent of their true value. The accuracy of modeled or otherwise estimated daily flows is less than the accuracy of gaged flows when all the data and modeling assumptions are taken into account. The report should discuss why the 3 percent effective reduction in recommended flow rates is not applied to all flow comparisons and is not a larger percentage reduction. **RESPONSE:** *A statement on error has been added to Chapter 7. Given the critical nature of the maximum interval, the reduction in the criteria for the gage difference was applied. It could have been applied to the other categories, but it would have made no difference. We have edited the language to indicate that it is a reflection of the gage difference, not gage error.*

Also, the draft report provides no data or information to support the recommendations regarding the maximum number of years that can be permitted to occur without meeting the specified combinations of flow and duration given as primary criteria. The report should explain the biologic, habitat or geomorphologic justifications for these specific recommendations. **RESPONSE:** *The statement on page 8-2 is the only justification that exists.*

Page 8-3, table 8.1. The frequency distribution values shown in table 8.1 represent both primary and secondary flow-duration criteria for the San Juan River. The sole support for the secondary flow duration criteria are the hydrologic modeling results for different water depletion scenarios given by the draft report at pages 8-16 through 8-19, figures 8.3 through 8.10, from which the numeric frequency values were selected based on modeled trends of flow-duration frequencies. Although the report at page 8-2, second paragraph, fifth and sixth sentences, recommends secondary criteria to mimic variation in the natural hydrograph, the secondary criteria were selected on the basis of modeled flow variability with some water development, which differs from natural hydrograph variability. The primary criteria shown in table 8.3 are to provide for the maintenance of geomorphologic conditions in the river channel for endangered fish habitat (for example, generating channel complexity and cobble, building and cleaning of cobble bars, and cleaning of backwaters and side channels). The report should explain the biologic, habitat or geomorphologic justifications for the secondary criteria. The report also should discuss fish habitat and flow needs on a reach-by-reach basis. **RESPONSE:** *The secondary criteria were not derived based on specific biological, habitat or geomorphological responses, but are based on mimicry. It is the only portion of the criteria that quantifies the stated need for variability. While the table was produced by examination*

of modeling results that approached the threshold primary values, providing the variability listed will provide variability that was judged adequate for the purposes of mimicry. Had the natural distribution been used (See Figures 8.3 through 8.10) these secondary criteria would have controlled the recommendation rather than the primary condition. Therefore, the variability requirements were described such that the primary criteria would always control. While many relationships were examined on a reach-by-reach basis, the flow recommendation has to address the entire river. Some discussion by reach is included, where appropriate, but the end result is one recommendation.

Pages 8-6 through 8-12, section entitled "Recommended Reservoir Operating Rules." This section recommends operating rules for Navajo Dam which would provide water releases in support of meeting the flow recommendations for the San Juan River below Farmington. For the flow charts of the operating rules given in figures 8.1 and 8.2, the term "perturbation" needs to be defined with direction as to how to determine when it has occurred. Also, in explaining the term "available storage," the report should clarify that the carry-over storage needed to prevent future shortages reflects the total storage in Navajo Reservoir, which includes inactive storage that is not available for diversion or release. The report also should compare the recommended releases from Navajo Dam with the inflow rates for Navajo Reservoir to evaluate the volumes and frequencies with which stored water would be released to augment bypassed inflow. **RESPONSE:** *The paragraph on p. 8-7 describing the use of Figures 8.1 and 8.2 has been edited to include the information you request. No analysis has been made of bypass vs augmented flow releases. Such information did not and would not influence the flow recommendation.*

Page 8-12, last paragraph. The Navajo Dam operating rules presented in the draft report are not flow recommendations themselves; rather, the operating rules, shown as flow charts in figures 8.1 and 8.2, are scenarios by which the flow recommendations for the San Juan River below Farmington might be met. Other scenarios, including an alternative formulation of the Animas-La Plata Project, might be able to provide enhancements to spring flows in some years so as to take some of the burden from the Navajo Reservoir water supply in meeting the flow recommendations. The target is to meet the variability provided by the San Juan River flow recommendations, not the variability provided by recommended reservoir operating rules. The topic of Navajo Reservoir operations is a matter of implementing the flow recommendations. The report should be modified to make this matter clear. **RESPONSE:** *See last paragraph on Page 8-12.*

Page 8-13, last paragraph. The RiverWare model for the San Juan Basin was constructed with an intent to evaluate impacts of alternative depletion and operation scenarios on San Juan River flows. The report describes the use of the model to simulate the effects that alternative operations of Navajo Reservoir would have had on San Juan River flows both after 1961 and prior to 1962 had the dam been in place. It is not clear why the model could not be used to simulate also river flows for historical conditions but without Navajo Dam in place for years after 1961 as well as for years prior to 1962, especially when the report claims that any collection of projects can be simulated for their impacts on San Juan River flows (see page 8-24, last incomplete paragraph, third sentence). The

report should discuss limitations to the use of the model, including the range of diversion and storage scenarios the model can simulate. The report also should explain how any limitations might have affected flow statistic values used to develop the flow recommendations. **RESPONSE:** *The model could have been used to extend the historic condition for this period of time. It was never configured to do so, which would have been a significant level of effort. The paragraph has been edited to reflect this possibility.*

Pages 8-16 through 8-21, figures 8.3 through 8.14. These figures need to be reviewed and corrected to reflect all modeling results. **RESPONSE:** *The corrections have been made.*

Page 8-24, third paragraph, last sentence. While Lake Powell might have flooded potential backwater habitat in the lower San Juan River, it also resulted in artificial backwater habitat due to sediment deposition at the head of the lake which lowered the stream gradient in the canyon. The report should either delete this sentence or provide data in support of the sentence indicating the net impact of Lake Powell on backwater habitat in the San Juan River. **RESPONSE:** *The net impact is not known, since the area was never mapped prior to being flooded. However, the loss of 77 miles of river, some of which was low gradient similar to reach 3, would have had much more backwater habitat than was gained in the 12-16 miles of river upstream of Lake Powell.*

Page 8-27, first complete paragraph, last sentence. Modeling tests with hypothetical scenarios were not only used to develop recommended operating rules for Navajo Dam, they also were used to derive secondary criteria for the flow recommendations as given in table 8.1. Again, the report should distinguish between the flow recommendations themselves and the possible implementation of alternative measures for addressing the flow recommendations. **RESPONSE:** *The model results were not used to derive the frequency distributions listed in Table 8.1, but to evaluate the impacts of various developments on the shape of the distributions to assure that the secondary criteria did not overrule the primary criteria. Table 8.1 is an integral part of the recommendations.*

Page 8-27, last two paragraphs. It is uncertain how the flow recommendations will be implemented in the field or in Section 7 consultations because there is no agreement in place between the Implementation Program participants and the Fish and Wildlife Service regarding Section 7 procedures. Therefore, it is uncertain what role, if any, Program participants or others will have in defining depletion baselines or in Section 7 consultations. These two paragraphs should be deleted from the report because they discuss possible future modeling in the context of implementing flow recommendations, not the development of the flow recommendations themselves. **RESPONSE:** *These paragraphs describe how the model may be used and the results interpreted for any purpose and include appropriate language to recognize that the depletion base used in the model runs is not the same as the environmental baseline. There is no requirement for the models to be used for any particular purpose. There is simply a description of how they could be used. The paragraphs will remain.*

I hope that the Biology Committee addresses these comments in the final report. I also hope that our concerns regarding the flow recommendations for the San Juan River can be dealt with effectively through future work of the Implementation Program and adaptive management.

Sincerely,
John Whipple
Staff Engineer

cc: Ren Lohoefener, Chair, Coordination Committee

MEMORANDUM

TO: Paul Holden - **VIA FACSIMILE AND U.S. MAIL**

FROM: Les Taylor and Jessica Aberly, Nordhaus Law Firm

DATE: July 26, 1999

RE: Comments on Behalf of the Jicarilla Apache Tribe Regarding the December 4, 1998, Draft Report: Flow Recommendations for the San Juan River

On behalf of the Jicarilla Apache Tribe, we submit the following comments regarding the draft flow recommendations report dated December 4, 1998.

- Tables 8.5 - 8.8, and Figures 8.3 - 8.18: References to "baseline" need to be revised to read "depletion base." **RESPONSE:** *This change has been made.*

- Page 7-17, 3rd paragraph: We request that the term "corrections" be put in quotation marks in the second sentence. We further suggest an additional qualification in that paragraph as follows: **RESPONSE:** *The changes you requested have been incorporated into the latest document.*

  > Those rights that the two states believed were likely to be developed were included in the depletion base.

- Tables 7.3 and 7.4: We request that a footnote be added to category entitled "current" which clarifies that this category includes existing Indian water rights depletions except for those otherwise specified in the table. Our concern is that a reader glancing at these tables will assume that the Jicarilla Apache Tribe has no current water rights or a right to only 25,500 afy of depletions. In fact, in addition to the 25,500 afy depletions, the Tribe has recently been adjudicated 2,194.58 afy (depletion) of historic and existing use federal reserved water rights. It appears that some of the Tribe's existing depletions are being "counted" in the non-Indian irrigation and non-irrigation figures.[1] Arguably, all of the Tribe's historic and existing use water rights should be "counted" as "current" since those rights are adjudicated federal reserved water rights which cannot be forfeited or abandoned.

[1] The same may be true of the current water uses of the Navajo Nation, the Southern Ute Indian Tribe, and the Ute Mountain Ute Tribe.

Alternatively, those rights should be specifically included in the "depletion base" since the depletion base does not necessarily track the environmental baseline and includes water rights that may not be presently fully utilized but are likely to be developed without a section 7 consultation. **RESPONSE:** *We assume that all existing water uses, whether on Indian lands or non-Indian lands, that are not tied to a major irrigation project are included. For lands above Navajo Dam and those not irrigated from the mainstem San Juan River below the dam, Indian and non-Indian lands are combined and tabulated by location. The Jicarilla Apache, Southern Ute, and Ute Mountain Ute irrigated lands are all included in these categories. We are editing the table to reflect this condition.*

- Page 8-27, second and third paragraphs: These paragraphs, as presently drafted, are troubling, because they imply a consensus amongst the SJRRIP participants that the model outlined in the flow recommendations report is *the* tool, not *a* tool, to evaluate proposed water development projects. If that is the position of the Biology Committee, then other portions of the document appear to be misleading. See, e.g., December 4, 1998 Draft Report at 7-9 ("There are several best-science river basin simulation models available, any one of which would be appropriate for developing and analyzing San Juan River flow recommendations.") and 8-12 ("These operating rules are presented as recommendations . . . . Other operating rules may be employed to achieve the desired river conditions specified in this chapter, if that [sic] the natural variability provided by the rules presented is maintained."). Even if this is the position of the representatives on the Biology Committee, it is not necessarily the position of the Coordination Committee. Indeed, we reiterate our November 20, 1998, comments on the September 16, 1998, Draft Report:

> The comments discussed herein should not be interpreted as approval of any of the hydrologic assumptions used to model the flow recommendations. The Jicarilla Apache Tribe is in the process of conducting an independent review of those assumptions. It is our view that the Coordination Committee (and the Tribe's representative on that committee) can allow the flow recommendations to go to the Bureau of Reclamation to begin the NEPA process without endorsing the entire document or all of the assumptions therein.

Accordingly, we request that the last two paragraphs be modified or deleted. **RESPONSE:** *The last two paragraphs of Chapter 8 essentially discuss how the flow recommendations would most likely be implemented. If another model is used to model the*

basin, or if other operating rules are developed, they also would be used very similarly to the model and operating rules as described in these paragraphs. Therefore, if another river model is developed, or other operating rules are developed, the process that would be involved in assessing if proposed water projects meet the flow recommendations would be essentially the same as discussed in this section. Hence, we have not changed these paragraphs.

We appreciate the opportunity to comment upon this latest draft report. We would be happy to discuss these comments further with you or with any member of the Biology Committee.

cc: Members of the San Juan River Recovery Implementation Program Biology Committee
Honorable Rodger Vicenti, Vice President, Jicarilla Apache Tribe
Honorable Joe Muniz, Council Member, Jicarilla Apache Tribe

From: "Errol Jensen" <EJensen@ibr4gw80.uc.usbr.gov>
To: BIOWEST.LOGAN(paul)
Date: 1/15/99 4:04pm
Subject: Comments on the Flow Recommendations for the San Juan River - Draft Report

Paul: Attached is a couple of comments on the Draft Report. If you have any questions, please give me a call (970-385-6589).

CC: BIOWEST.smtp("LCRIST@ibr4gw80.uc.usbr.gov","PSchum...

Comments on the "Flow Recommendations for the San Juan River" Draft Report dated December 1998

Page 7-13, 4th full paragraph, Paragraph starting with "The proposed Animas-La Plata Project....", last sentence - 56,610 af should be changed to 55,610 to match with the numbers on page 7-17 and tables 7-3 and 7-4. **RESPONSE:** *We have made this correction.*

Also, need to add a footnote to the end of the paragraph stating something to the effect:

The 1996 Section 7 consultation and resulting Reasonable and Prudent Alternative for the Animas-La Plata Project are based on an average annual depletion of 57,100 af and 149,200 af for Phase 1 of the Project and the full Project respectively. The difference between these numbers and numbers stated in the text can be contributed to different models and different modeling methods. **RESPONSE:** *We have added additional explanatory language on p. 7-13 and in Tables 7.3 and 7.4.*

COMMENTS ON

Flow Recommendations for the San Juan River

Draft Report

December 4, 1998

Submitted by

Tom Pitts

on behalf of

San Juan River Basin
Water Development Interests

January 18, 1998

Overall General Comments

1. The errors of estimation that are built into the model used to develop the flow recommendations need to be discussed in the report. For example, the gauges on which the flow analyses are based are only accurate within 10 percent. In addition, other errors have been added and compounded into the model, based on the fact that a) it is a model, b) numerous estimates had to be made, c) the model was based on less than a complete data base, and d) there are errors in the baseline (existing use) estimate, among others. **RESPONSE:** *Regression coefficients are presented for perturbation and habitat models. We have added language to discuss the impacts of model error in Chapter 7. The fact that there is not agreement as to the depletion base has been acknowledged repeatedly in Chapters 7 and 8.*

2. Flow-habitat relationships are mentioned but none could be found in the report. Only apparent associations of habitat with short-term flow changes are described. The descriptions of procedures and results of measurements and mapping of habitat during the study period also give the impression of having considerable latitude in interpretation, yet specific flows are prescribed almost entirely on the basis of an empirical associations between habitat and flow characteristics. No attempt was made to corroborate the empirical conclusions, but without corroborative analyses, any investigator's conclusions of cause-effect relationships in any data set are subject to different interpretations by other investigators. The occurrence of habitat under certain flow conditions does not prove a cause-effect relationship. **RESPONSE:** *See Chapter 7 for the flow/habitat model dealing with backwaters. We acknowledge throughout the report that the recommendations are based on the best information we have in hand and that they are not final, but are subject to adjustment through the adaptive management process as more is known. Further, the recommendations embody the collective interpretation of the researchers with oversight from the peer review panel.*

3. The report's conclusions appear to be based on a predisposition for reliance on and acceptance of short-term cause-effect relationships. The geomorphology of a stream this month is not necessarily formed, or even maintained, by this month's hydrology, yet the report makes numerous short-term associations of geomorphic/habitat conditions with immediately-preceding flow characteristics. Managing the fluvial habitat of a river this way might be intuitive or even possible, but is not consistent with geomorphologic principles. Flow regime changes should not be proposed without establishing how the river will respond and whether the response will be immediate or delayed, or temporary or permanent. **RESPONSE:** *The recommended flows are based on mimicry of the pre-regulation hydrograph, with all the variability that existed. There is no disagreement that the fluvial habitat is based not just on the present hydrology, but the hydrology for several previous years and possibly decades. Mimicry of the natural hydrograph preserves those very complex relationships that form the channel morphology and affect fluvial habitat. However, there are a few conditions that are shorter term in nature in the San Juan River, and probably other systems. The 7 years of data that we have along with an analysis of the geomorphological processes form the basis for backwater and low velocity habitat cleaning*

and for cobble transport necessary for cobble bar building. To understand and define all the relationships between hydrology and the geomorphological processes that form and maintain the features influencing fluvial habitat would be an impossibly difficult task for 200 miles of river. With seven years of data, a look at multiple year processes and the impact on habitat has been possible and the habitat response to a series of flows that represented mimicry of a natural hydrograph lead to the relationships developed.

4. A principal concern with the report's focus on mimicking flow hydrographs is that sediment transport and geomorphologic relationships, and the resultant impacts on riverine habitat, cannot be derived from hydrograph analysis alone. Inventories and analysis of sediment sources, characteristics, changes and transport relationships must be combined with flow analysis before reaching conclusions. Simple procedures, such as estimating effective flow values (dominant discharge) link the flow hydrograph with sediment-transport and channel-forming processes. By these or other similar methods, a much wider range of hydrograph regulation can be investigated to accomplish the same geomorphic and habitat results. **RESPONSE:** *Inventory and measurement of sediment sources were not possible in the San Juan River. The bulk of the sediment inflow occurs during short duration storm events distributed in over 100 major and 500 minor inflow points in 200 miles of river. While performing a sediment balance study would have been desirable, it was not practical. Mimicry of the natural hydrograph incorporates both biological and geomorphological response. Managing a stream based solely on the basis of sediment transport conditions is not wise, especially given the limitations of the data in the San Juan.*

5. Bank-full flow is offered as an index of channel maintenance, and a single value of 8,000 cfs is used for the entire river in setting flow recommendations. Using a single value for this much river length is unprecedented, and the bankfull flow rate is a weak and very subjective index, and is considered by most to be the weakest index for this purpose. Effective discharge or other measures are much more widely-accepted indices of the channel maintenance flow rate. **RESPONSE:** *See Chapter 4 for a discussion of how the 8,000 cfs recommendation is derived and what it means. The report clearly specifies that there is a range in bankfull conditions in the San Juan River and acknowledges that a range of flow magnitudes, durations and frequencies is important. The sole purpose of the 8,000 cfs in not channel maintenance.*

6. It has been assumed that 8,000 cfs is a channel maintenance flow because it equates to the bankfull flow. Equating channel maintenance flow with bankfull is subject to widespread disagreement in the scientific community. If channel forming flows are less than channel capacity, this could have significant effect on flow recommendations. The correlation between scour and peak discharge in the draft report is very weak. **RESPONSE:** *It is incorrect to speak of a flow magnitude without discussing duration and frequency, in terms of its utility for channel maintenance or any other purpose other than bankfull. We are mimicking a natural hydrograph, not specifying a flow condition only for channel maintenance. Read Chapter 4 for a more complete discussion of the derivation and utility of the 8,000 cfs recommendation.*

7. At the July 8, 1998 Biology Committee meeting, additional data were presented concerning 1) extension of the "without dam" hydrology to a period from 1929 to 1996 , including the very dry 1960's; 2) channel capacity before and after the dam; and, 3) the statistical relationship of YOY catches versus 8,000 and 10,000 cfs flows. Although the Committee chose not to adjust the draft flow recommendations at that time based upon this new information, these data should be included within the appendices because they were mixed in support of the flow recommendations. For example, with the reduction in channel size, a flow of 10,000 cfs presently is equivalent to a flow of 13,000 cfs prior to the dam. The argument could be made that frequency and duration should be based upon those values for the 13,000 cfs event. Likewise, an analysis of the YOY data, if assumed to be statistically significant, showed a correlation to 8,000 cfs but not 10,000 cfs. To be considered as unbiased as possible, our draft report needs to include findings which support the flows being recommended as well as those that necessarily don't. **RESPONSE:** *The material you refer to was not included because it was too speculative in nature. The comparable pre-dam conditions listed in the table were developed on an assumption in the reduction of channel capacity. No hard data exist to determine channel capacity before the dam was built. We only know that it was greater. We do know that statistically, the 10,000 cfs flow/duration/frequency relationship for the flow recommendation is about what the 13,000 cfs flow/duration/frequency relationship was pre-dam, indicating that the recommendation accounts for a smaller channel.*

8. In reading the report, a number of minor questions were raised that may have simple explanations upon further investigation, or may have affected the results. These include things such as:

   - How can the aerial survey of islands used in developing the channel complexity index distinguish an island from a lower-height bar or dune? **RESPONSE:** *The islands are identified by on-the-ground mapping using aerial videography as a base map.*
   - Why are some of the reaches described as "stable" when the same descriptions include discussion of bank protection? **RESPONSE:** *The bank protection and diking is partly responsible for the stability of the channel. When the lateral movement of the channel is confined by dikes and bank protection, the channel becomes less dynamic.*
   - If armoring has occurred, why doesn't the study examine means of protecting these zones as cobble bar habitat by reducing flows that would otherwise disturb or remove the armor layers? **RESPONSE:** *Armored reaches do not provide spawning habitat. Open interstitial space is required for spawning conditions and armored, stable bars have little, if any, open interstitial space.*

9. An important assumption underlying at least a portion of the draft recommendations is that the response of native, but non-endangered, fish is an acceptable surrogate for the response of the endangered species. The merits of this assumption need to be thoroughly explored and openly

discussed. As the draft now stands, the positive response of bluehead suckers to high flows serves as major justification for the 8,000 cfs recommendation. However, flannelmouth sucker showed no such response. Such conflicting results need to be presented and discussed in a less biased manner where undue significance is not given to one finding over another, thereby weakening the credibility of the report. **RESPONSE:** *We do not agree that because bluehead and flannelmouth sucker do not have the same response to flow, that the results are conflicting. Having two of the three common native fish (bluehead sucker and speckled dace) respond favorably in reproductive success to higher and longer flow periods would suggest these types of flows are important to the native fish community. Flannelmouth sucker reproductive success appears to be related to factors other than spring flow magnitude and duration.*

10. There is no scientific justification for the 10,000 cfs flow recommendation. **RESPONSE:** *Both Colorado pikeminnow and razorback sucker, and both juveniles and adults of both species, tended to select habitats in complex river reaches. Flows of 10,000 cfs and greater are the only flow levels that will maintain and potentially increase complexity in the river. See discussion on pp 4-11 to 4-12, 6-7, 8-3.*

11. Many of the definitions in the glossary are weak. The authors may want to check the American Fisheries Society List of Aquatic Terms being developed by Neil Armantrout. In addition, the authors may want to add "juvenile", "PAH", "GUI", "DMI", "acute toxicity", "habitats (run, riffle, shoal, slackwater)" to the glossary, as well as "endemic", "indigenous", "non-native", and "exotic". **RESPONSE:** *We appreciate your suggestions. Some of the abbreviations you note are on the chapter cover pages, and some of the words are in the Glossary. We have added some of the other terms to the Glossary.*

CHAPTER 1 - INTRODUCTION

Specific Comments

1. On the last paragraph of page 1-1, is it fair to say that "the Colorado squawfish and razorback sucker were widespread and apparently abundant...including the San Juan River?" Historic collections do not provide sufficient information to make this inference. The species were present, but historic abundance and distribution in the SJR are not well documented. **RESPONSE:** *The Biology Committee feels that the capture of adult and young fish with very little effort during pre-dam periods suggests more than just presence in the river. Population levels similar to present conditions would not have been detected pre-dam with the effort that was expended, hence, we have concluded that populations were widespread and relatively abundant.*

CHAPTER 2 - GEOMORPHOLOGY, HYDROLOGY, AND HABITAT OF THE SAN JUAN RIVER

General Comments

1. Discussion of historical occurrence of backwaters should be included. Because of the steep gradient and channel morphology, the predam river likely could not support an extensive backwater habitat. The San Juan does not nor ever did support flooded bottom lands required for razorback suckers. How can this species be recovered in a river that never had nor ever will provide for the fishes required habitats? **RESPONSE:** *There are no historically available data to accurately assess backwater habitat during pre-dam conditions. The pre-dam aerial photography was taken at a flow too high to accurately map backwaters. Therefore, no data are included. However, an examination of the photos indicate a very complex channel with ample opportunity for backwater formation. Studies with YOY Colorado pikeminnow indicate that nursery habitat for this age fish is not limiting in the system. You are correct that very little, if any, flooded bottom land exists in the San Juan floodplain. It will be unknown if YOY razorback suckers will use some other low velocity habitat in the San Juan River until millions of larvae are produced in the river, hopefully in the next few years. See page 4-52.*

2. The length of time that it takes for habitat degraded due to storm events to recover should be discussed with supporting data included. **RESPONSE:** *See the discussion on the flow/habitat model in Chapter 7. The model accounts for degradation based on the number of storm event days. Recovery depends on the flushing flow conditions being met.*

3. One weakness in the argument for flow recommendations is the lack of a geomorphic/hydrologic link to habitats, particularly backwaters. Since backwaters are the most important habitat for YOY Colorado squawfish, it is intuitive that understanding mechanisms for backwater formation are vital to flow recommendations. The draft report needs to emphasize the contribution of bedform to available habitat, not just current hydraulic conditions, and highlight the role of antecedent flow regimes in creating the habitat we observe at any instant in time. Along this same line, the draft report lacks a solid and defensible definition for a "backwater". For example, in Table 2.1, a backwater is "Typically an indentation of channel...", while the Glossary on page G-1 defines a backwater as "A pool type formed by an eddy along channel margins...". Neither definition provides a link to geomorphic processes that can be quantified in support of certain flow recommendations. For example, eddy return channels form in association with large recirculating eddies, chute channels form in association with low elevation channels, scour channels form on sand islands, etc. Knowing and understanding the type of backwater that the fish are using and relating type with geomorphic process and hydrology strengthens the argument for certain flows that create these habitats. **RESPONSE:** *The definition of Backwater has been edited. The bulk of the backwaters in the San Juan River, especially the more stable backwaters, occur at the mouths of seasonally dry secondary channels. Further, the correlation with flow conditions during the previous spring runoff is stronger for the secondary channel associated backwaters than other main channel backwaters, and since the secondary channel backwaters*

make up the bulk of the total, the correlations for total backwaters are similar to those for secondary channel backwaters. See pp. 4-30 to 4-32 and Table 4.12.

Specific Comments

1. Aerial videography was used extensively to analyze habitat availability and channel complexity (e.g., p. 2-21, p. 4-9). The efforts made to "ground truth" this information should be described and appropriate literature cited to support this relatively new technique. **RESPONSE:** *Aerial videography was used as the base map. Actual mapping was completed on-the-ground as noted on page 2-21.*

CHAPTER 3 - LIFE HISTORY OF THE FISHES OF THE SAN JUAN RIVER

Specific Comments

1. A discussion of productivity related to summer storm events is needed in the section of larval survival (Page 3-8). Bestgen's data concludes that food is a determining factor for survival and growth of larval squawfish. If summer storms affect food production in the San Juan at the critical stage for larvae, then survival of these larval fish will be greatly reduced. **RESPONSE:** *Productivity (biomass) is discussed at the end of Chapter 2. Any effect of late summer storms on larval pikeminnow would be pure speculation at this time. This issue will be studied in the future once sufficient larval pikeminnow are available in the system for study. Young-of-the-year pikeminnow stocked at less than 50 mm have grown exceptionally well in the San Juan River during years with extensive late summer storm events.*

2. Page 3-13; Some additional discussion of the effects of lacking flooded bottomlands in the San Juan for razorback staging is needed. This is a critical habitat requirement in the Green and Colorado rivers and if lacking in the San Juan may limit recovery. **RESPONSE:** *See the response to a similar question above and page 4-52.*

3. Page 3-23, paragraph 5, speculates that the roundtail chub is the most abundant carnivore in the Upper Basin. However, unpublished data from Valdez, Masslich and Leibfried for 60 fish collected from the Colorado River near Stateline indicates roundtail chub stomachs rarely contained fish. **RESPONSE:** *Carnivore means that the fish feeds on animal material as opposed to plant material. Insects are also eaten by carnivores. Piscivores feed primarily on fish.*

CHAPTER 4 - PHYSICAL AND BIOLOGICAL RESPONSE TO TEST FLOWS

General Comments

1. As the results in Chapter 4 and the recommendations in Chapter 8 are presented, it is apparent that 8,000 cfs is the channel maintenance flow and 2,500 cfs is the estimate of the flushing flow needed to maintain cobble quality for spawning. In a regulated river, it is possible for these two flow levels to be incompatible (Kondolf and Wilcock, 1996). If the channel maintenance flow moves spawning cobbles out of the system at a faster rate than they are replenished due to

upstream storage, these recommendations potentially could be setting a mechanism in place which in the long-term could result in loss of spawning habitat. While such a scenario may seem a bit farfetched given the sediment sources coming into the SJR below the dam, the question should at least be asked and the draft report should at least briefly attempt to answer it. What do we really know about cobble transport into and through the system? What do we know about the quantity, quality and location of cobbles stored within the floodplain environs that our 8,000 and 10,000 cfs flows are intended to erode and make available? Are there any possible adverse affects associated with this from the standpoint of habitat quality? The report needs to include mention of these possible concerns. **RESPONSE:** *See pp 2-1 to 2-2 for a discussion of the abundant cobble source in the flood plain. Examine Table 2.2 "eroding bank" which shows the abundance of unstable banks that contain cobble and gravel. Cobble supply is not a concern, as long as the channel stays active.*

2. The 1st draft of this document discussed the apparent positive effect the late 1980's drought had on speckled dace. Why was this deleted? As mentioned earlier, the report needs to remain as unbiased as possible in our presentation of results, especially in Chapters 4 & 6. **RESPONSE:** *The earlier draft of the document indicated that speckled dace did not disappear during the drought period, not that there was a positive effect. It is likely that speckled dace numbers declined during that period. This information was in reference to a statement that this short-lived species may be impacted by several consecutive drought years. These statements in slightly revised form are still on p. 4-17 of the December 4 draft.*

Specific Comments

1. Justification for the 10,000 cfs recommendation is based almost solely on the use of "island count" as an index of channel complexity (p. 4-11). The use of just this one surrogate parameter needs to be supported by appropriate citations from the geomorphologic literature and additional detail provided on how the measurement was actually done. Dr. Tom Wesche has attempted to use "island count" to quantify long term channel simplification in response to flow regulation on several large Wyoming rivers, his results have been mixed and difficult to explain. Also, Dr. Wesche has always used other parameters (e.g., change in width-depth ratio, variability in bankfull depth, change in meander geometry) in conjunction with island count. Assuming the literature supports the use of "island count", then the question becomes how has this index of complexity changed historically. Is there quantifiable evidence from historic aerial photographs that the count has changed substantially? Can a case then be made that such changes have lead to habitat simplification for the fish? Given the significance of this flow recommendation, the report needs to provide as much justification as possible. If such a case cannot be made, we need to carefully explain the reasons. **RESPONSE:** *The basis of the 10,000 cfs is first to mimic a portion of the natural hydrograph that has been most heavily modified with reservoir operation. The need for restoring these higher flow rates was first established by observation of the function of the flood plain and then verified with the island data analysis. Restoration of high flows in the more heavily vegetated flood plain had the possibility of degrading and simplifying the channel. When higher flows less than 10,000 cfs occurred (1992-1994) this appeared to be*

happening. The trend was reversed and channel complexity restored when the flow conditions above 10,000 cfs were met (See Figure 4.6 and discussion on pp 4-9 to 4-13). The long term change in island count deals with permanent islands under bankfull condition and does not directly relate to the analysis of channel complexity at low flow (1,000 cfs).

2. The assumption is made in Chapter 4 (e.g., p.4-13, 4-14) that bankfull flow is the same as the effective discharge for the SJR, the implication being that 8,000 cfs is the channel maintenance flow. Measurement difficulties aside, an unstated assumption underlying this is that the SJR is in a stable condition. Bankfull flow is meaningful as a measure of channel formative or maintenance flows only if it is first shown that the river has reached a state of dynamic equilibrium. Furthermore, equating channel maintenance flow with bankfull is subject to widespread disagreement in the scientific community. For example, after hearing extensive testimony by several experts (including Dr. Luna Leopold and Dr. Stanley Schumm), the Colorado Division 1 Water Court adopted as more compelling the definition that channel forming flows are less than channel capacity , and that channel forming flows are referenced more appropriately to the level at which the incipient floodplain is being formed rather than the present main channel capacity. Likewise, studies on the upper Colorado have revealed that effective discharge is less than the bankfull discharge (Pitlick and Streeter, 1998). Although the sediment transport rating curves needed to quantitatively determine effective discharge are not presently available, the report needs to bolster the justification for use of bankfull as the channel maintenance flow in order to avoid criticism. Along these same lines, it needs to be recognized in the report that flows other than bankfull or the annual peak can and do play a role in transporting sediment through the system. This could be why on p. 4-4 and Figure 4-1 the correlation between scour and peak discharge is weak. Perhaps Ellen Wohl can be of help on these matters. **RESPONSE:** *Bankfull is not equated to effective discharge in the report. 8,000 cfs for 8 days with an average frequency of 33% is discussed as necessary primarily to transport cobble and secondarily maintain channel capacity based on the recurrence frequency of this magnitude and duration post-dam and the loss of channel capacity that has resulted. Further, the 8,000 cfs is the flow considered necessary for cobble transport for bar building based on the four modeled reaches. If the pre-dam effective flow had been used as the target (computed to be about 7,000 cfs), the frequency and duration would have increased relative to 8,000 cfs, resulting in a similar overall flow recommendation. If the results of continued monitoring show this, or any other flow recommendation, to be too high or too low, there is opportunity to modify the recommendation.*

3. Page 4-29, 2nd paragraph: The basis for the 21-day duration of the 5,000 cfs flow is based on conditions in reach 3. However, few, if any, endangered fish were found in reach 3. Without the reach 3 data, the duration would be seven days. This could result in a significant difference in terms of water releases for endangered fish. **RESPONSE:** *Stocked YOY Colorado pikeminnow have been found in Reach 3. This reach has the highest abundance of backwater habitat when flushed and the greatest distance below the upstream spawning sites of the reaches that can be influenced by flow manipulation, an important consideration for larval drift.*

4. For razorback sucker telemetry data (Page 4-38) the number of individuals used to make habitat preference determination should be stated. Are there enough to make this analysis valid? **RESPONSE:** *On p. 4-49 it is noted that 57 razorback sucker were radio-tagged. These were the fish used in the analysis.*

5. Page 4-40: Previous sections discuss the fact that temperature may override flow effects. No mention of year to year temperature variation is found in the section on squawfish early life stages. This should be included as a non-flow limiting factor and discussed. Also, the effect of storm events on food availability should be discussed here. **RESPONSE:** *We are not sure what earlier sections you are referring to. The temperature/flow discussion was primarily related to Colorado pikeminnow spawning time, not reproductive success. Refer to our answer above related to food availability and storm events.*

6. Table 4-14, on p. 4-41, lists data regarding young-of-the-year and juvenile squawfish collected in the San Juan River. These data are scant and not related to catch per unit effort. These data do not support the inference "that high flow years with naturally shaped hydrographs like 1987, 1993, 1994, and 1995 are important for Colorado squawfish reproductive success." **RESPONSE:** *This section has undergone considerable change as the Biology Committee has investigated this information. It is the consensus of the Biology Committee that the way this information is presented is accurate. The fact that it fits with what has been learned in other Upper Basin rivers lends credence to the conclusions in the San Juan Basin.*

7. Page 4-42: For adult squawfish, are four fish one year and five fish another a valid sample size to make habitat preference determinations? Small sample size and the associated error for telemetry observations should be discussed. A table for habitat availability and use would be beneficial to the reader. **RESPONSE:** *As is always the case with biological information, more data would always be helpful. Since so much of the habitat information from these few fish indicated habitat use was very similar to other pikeminnow populations in the Upper Basin, it strengthened the validity of these data.*

8. Page 4-48, 2nd paragraph: Can the SJR temperature data that has been collected be used here to support the Upper Colorado data? At some point in the report, the SJR temperature data needs to be brought in and evaluated as a possible limiting factor. **RESPONSE:** *We suspect you are referring to recent work by Doug Osmundson on temperature. Temperature in the upper San Juan River will continue to be investigated as we repatriate the endangered fish to this area.*

9. Page 4-48, last paragraph: If there is a "question about the overall suitability of backwaters in the San Juan for squawfish," then recommending flows to maintain these questionable habitats is questionable. This may be an area of monitoring under the Adaptive Management Program. **RESPONSE:** *This question was answered in the ensuing section of the report. Nursery habitat for young Colorado pikeminnow in the San Juan River includes a variety of low velocity habitats, and backwaters were more common than some people thought. This information made*

the use of backwaters even more important in the flow recommendations, and not questionable at all.

10. For flannelmouth suckers, additional analyses should be considered to determine correlations with temperature, food availability, and turbidity. **RESPONSE:** *We agree that the changes observed in flannelmouth sucker populations needs additional study. We anticipate that the monitoring information will be useful in evaluating these changes.*

11. Pages 4-53 to 4-68: For both flannelmouth and bluehead sucker data a relationship between year class strength and other non-flow limiting factors should be analyzed. This would include temperature, food availability, storm event turbidity increases and potential competition with nonnative fishes. **RESPONSE:** *Information on these factors is not available for all the years, or in some cases for any of the years, studied to date. These non-flow factors will likely be investigated during the Synthesis Report analysis.*

12. Pages 4-68 to 4-72: In the first paragraph of the speckled dace discussion on page 4-68, the author dismisses the lack of correlation between September dace numbers and availability of high flows because of a shift in habitat usage. However, in the last paragraph beginning on 4-68, when September dace numbers appear to follow the author's preconceived flow-fish relationship, no mention is made of the previously discussed habitat shift. **RESPONSE:** *As noted in that section, the first paragraph refers to main channel collections by UDWR, the last paragraph refers to secondary channel collections made by NMGF. Riffles were not sampled by UDWR, but were by NMGF. Hence, two different sets of data were being discussed, which suggests the conclusions may also be different.*

13. The discussions of nonnative fishes beginning on Page 4-72 should explain that flow augmentation to date has probably benefitted the nonnative fishes as well. **RESPONSE:** *The conclusion drawn by the Biology Committee was that nonnative fish were not reduced by flow changes, but the data do not support a conclusion that they were benefitted. By and large, populations of nonnative fishes changed during the 7-year research period but did not increase or decrease markedly.*

CHAPTER 5 - CONTAMINANT CONSIDERATIONS IN THE FLOW RECOMMENDATION PROCESS

General Comments

1. In regard to Chapter 5, contaminants in the San Juan River have been a historical event and may have been a limiting factor for these fishes prior to construction of Navajo Dam. Since the decision was made to include this chapter in the report, why not discuss contaminants as a non-flow limiting factor? **RESPONSE:** *The extent of historical contamination (prior to the beginning of good data collection in the last 20-30 years) is not known, although the upstream mining activity in the Animas suggests that it could have been a problem. We have not identified*

any contaminant yet that would be a limiting factor. However, discussing the full range of contaminant effects is beyond the scope of the flow recommendation report.

CHAPTER 6 - SUMMARY OF FISH HABITAT/FLOW RELATIONSHIPS

None

CHAPTER 7 - FLOW RECOMMENDATION DEVELOPMENT PROCESS

Specific Comments

1. The inventory of the types of habitat reveals that the preferred habitats are very rare (usually less than 1 percent of the total wetted area) and the report implies that they cannot be increased by flow regulation. The authors state on p. 7-1 (second paragraph) that the "abundance [of the controlling habitats] is not as directly affected by flow…" It seems unreasonable and scientifically incredible to conclude that these infrequent, micro-features can be maintained by macro-regulation of flows. **RESPONSE:** *You have mis-read the statement. The paragraph and Table 7.1 comment that backwaters and cobble bars are the primary controlling habitats in the flow recommendation since they (1) respond to flow in abundance and quality, (2) are very important to the life history of the fish and (3) have been most heavily affected by the altered flow regime. The habitats you reference, while important, are not limiting to the life stage of the fish that are using them and either do not respond to changes in flow or maximize at high flows that are impossible to provide. Since they don't respond to flow, they were not diminished by dam regulation. The recommendations are based on habitats that matter to the fish and that can be substantially influenced by changes in the flow regime*.

2. Page 7-3, second paragraph: The perturbation (habitat/flow) model needs to be explained more clearly to the non-geomorphologist. What does this mean to the ability of the fish to feed under perturbations to the system? **RESPONSE:** *The perturbation model applies only to backwater habitats and is related primarily to their availability expressed as total area (see p 7-3). Associated with a reduction in area is a reduction in water depth due to increased sediment depth. Impact on food availability is not considered in the model. Food availability may be reduced, but growth of the stocked YOY Colorado pikeminnow has been high during the test period when perturbations occurred.*

3. Page 7-8: If squawfish spawning did occur during a period where the 8,000 cfs condition for 8 days was not met, then why should this criteria be implemented. This is a "biological-response" driven model and a biological response was observed with less than the required condition. **RESPONSE:** *8,000 cfs for 8 days is the condition required to build bars and is only required one year in three. Spawning area can be maintained on these bars between rebuilding flows by flows of 2,500 cfs for 10 days.*

4. On Figure 7.4, the areas shown as "key young-of-year" habitat do not correspond to the captures of YOY shown on Figure 4.13. Shouldn't they? **RESPONSE:** *This notation was removed from the schematic in the December 4, 1998 draft.*

CHAPTER 8 - MODEL RESULTS

General Comments

1. The recommended "maximum periods" between recommended flows have significant impact on water releases for endangered fish. The "maximum periods were based on the collective judgement of the Biology Committee members of the maximum time possible between conditions before substantial or irreversible impacts to the fish or their habitat resulted, and in all cases, are at least as long as the historical pre-dam statistics indicate." No substantive basis for these recommendations is provided. **RESPONSE:** *You are correct. The values resulted from long discussions and are judgments that are subject to revision through adaptive management.*

2. Sensitivity analyses need to be conducted with the model on the potential range of key parameters, including maximum periods, duration, and bankfull flow, to determine the effects of realistic variations on water releases. The results of these analyses should be incorporated into the report and reflected in the flow recommendations. **RESPONSE:** *The sensitivity analyses you suggest would only have impact on the amount of water development allowed for most of the parameters listed. Many of those analyses have been made and the results reviewed by the Biology Committee in arriving at the recommendations in the report. In fact, by examining the results in the tables and figures in Chapter 8, the impact on future development of many of these parameters can be seen. Only utilizing a different magnitude for the 8,000 cfs condition is not presented in the tables. Since duration and frequency would have to change if a lower value was used here, the end result would be minor.*

Specific Comments

1. On p.8-3, Table 8.1 "Frequency distribution table for flow/duration recommendations" includes a variety of frequencies and durations that go far beyond the primary flow recommendations. There is no basis whatsoever in the report for the frequency duration recommendations that are not primary criteria. There is no basis whatsoever in the report for stating that "natural variability maintained by meeting conditions in Table 8-1" is part of the flow recommendations. Table 8-1 needs to be deleted from the report. Only the appropriate primary criteria should be included, after modification based on the comments submitted herein and comments by others. **RESPONSE:** *Table 8-1 is critical to the condition of mimicry. The condition of maintaining variability similar to natural conditions is inherent in hydrograph mimicry and is specified as an underlying condition for mimicry in the San Juan (page S-1, S-5, 8-1).*

2. Page 8-4: Purpose of 8,000 cfs. One of the purposes is that 8,000 cfs had a positive response for bluehead sucker and speckled dace. Where is the data to support that what is good for these fish

is good for squawfish when these fish are not endangered? **RESPONSE:** *The native fish community is of interest and concern to the SJRIP. These species are part of that community. Healthy native fish communities supported healthy populations of the endangered species. Recovery of the endangered fishes without a healthy native fish community is likely not possible.*

3. The purpose and use of Table 8-4 on page 8-12 is not clear, nor the description directly above the table. Are the minimum carryover storage amounts just informational or are they to be used in the decision tree? Please clarify. **RESPONSE:** *The description of the use appears on page 8-7 under the fourth bullet describing the use of the operating rules in the model. This is a calibration parameter in the model that protects against water shortage in future dry years.*

January 15, 1999

Mr. Ron Bliesner
Chairman, SJRRIP Biology Committee
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78 E. Center
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Dear Ron:

The following are the State of Colorado's comments for your consideration and inclusion in the Biology Committee's December 1998 "Draft Flow Recommendations for the San Juan River." These comments are limited in scope to the "technical and scientific" aspects of the report as agreed to the December 1998 Coordination Committee meeting. The comments previously provided concerning "administrative and implementation" issues will be addressed in other aspects of the San Juan RIP.

GENERAL COMMENTS

1. The San Juan River RiverWare model used to develop flow recommendations is a planning model that makes a number of assumptions on who will develop water and how they will do it. While it is clearly stated that the flow recommendations are subject to adjustment through the "Adaptive Management" process in the future, there does not appear to be clear language that anyone can develop a portion of the water identified as available for development at any time. As a result, there should be a mandate to adjust the modeling assumptions and flow recommendations on any regular basis.

   Major model assumptions include:

   a. The release rate from Navajo Dam. A discussion of the 6,000 c.f.s. versus 5,000 c.f.s. release rate at Navajo Dam is included and it appears either release rate will support the flow recommendations and the same level of water development. The U. S. Bureau of Reclamation ("Reclamation") might be able to make releases in the range of 5,200 to 5,500 c.f.s. from Navajo Dam and stay, for the most part, in the existing San Juan River channel. However, the 5,000 c.f.s release should not be exceeded at the present time based on information provided to the Coordinating Committee by Reclamation and the U.S. Army Corp of Engineers. The option to release additional water, up to 1,000 c.f.s., through the Navajo Indian Irrigation Project ("NIIP") canal should be mentioned as a possibility until the research clearly ruling it out is completed. **RESPONSE:** *This is not an option that would be available universally, and certainly not at nearly that capacity during the time of year it would be needed. It is beyond the purview of the SJRIP to access any NIIP features other than Navajo Dam.*

b. Where, when and how future water development occurs will impact the basin hydrology making it either easier or harder to achieve the flow recommendations at certain times. This will need to be evaluated on a regular basis. **RESPONSE:** *We agree. The tools are provided to do this.*

2. Not all flow recommendations appear to have a strong supporting biological basis, and therefore may ultimately not be critical for recovery. For example, the 10,000 cfs peak appears to have as many arguments against it as for it. For example, on page S-2 it is noted that an important feature for Colorado Pikeminnow (Squawfish) spawning is very clean cobble bars with very little fine sediments between individual cobbles. If this is the case, why interject sediment and debris into the river system with overbank flooding, especially when downstream property damage potential has not been identified as part of the research program. Furthermore, while backwaters are important for young Pikeminnow, it is noted on page S-3 that there are other low velocity habitats necessary for the survival and growth of the young Pikeminnow. Finally, it is also noted on page S-3 that high flows on the San Juan did not repress non-native fish populations. All these factors appear to argue against a 10,000 cfs peak flow at least at this time. The Biology Committee needs to provide better indication of the most important goals to try and achieve at present (more spawning bars, more low velocity habitat, or more adult habitat). This would help decide what to strive for when making Navajo releases to shaping a peak. **RESPONSE:** *Sediment and debris are not a major factor during high spring flows, but rather are a concern during late summer and fall storm events. High spring flows have sufficient hydraulic force to move cobble and thereby clean sediment from spawning cobbles. Low velocity habitats are often most abundant in complex river reaches which the 10,000 cfs flow creates and maintains. We do not understand why failure to depress nonnative fish would argue against a 10,000 cfs flow since this flow was not recommended to reduce nonnative fish. As noted throughout the document, spawning habitats and nursery habitats are the focus of the flow recommendations, but adult and juvenile habitat are also provided for by this level of flow.*

3. Each section under the "Recommended Hydrograph Conditions" should contain references to the work or section of the report that supports or is the basis for the recommendation. The reader needs to know and understand the strength of the research given the often competing results. **RESPONSE:** *The primary purpose of Chapter 6 is to provide this type of comparison and that information is summarized under each Recommended Hydrograph Condition.*

4. Peer Group. Peer Group review has indicated that: a) the number of fish collected are not adequate to develop sound conclusions; b) a discussion of the impact of non-native fish needs to be provided; and c) general support for the process and of the direction of the Biology Committee in making the best use of the little data available. We understand Peer Group comments will be

integrated into the next version of the flow recommendations. **RESPONSE:** *Peer Review Panel comments have been addressed in the final report.*

5. On page 1-5 it is noted that actual stocking was initiated in 1994 when it became clear that existing population levels in the San Juan River system were too low to measure responses. Has this stocking effort been adequately considered in all the studies supporting the flow recommendations? **RESPONSE:** *Yes it has.*

6. Develop a table of research needs such as those associated with the 10,000 cfs peak flow and as indicated at the top of page 6-7, on page 4-40 and on page 7-7. **RESPONSE:** *Nearly every aspect of the flow recommendation needs either future monitoring for verification or additional research. We believe it is beyond the scope of this document to identify future research needs in any comprehensive manner. The synthesis report will address the research needs while the monitoring plan will address the monitoring requirements, all of which will be used to verify and update flow recommendations.*

SPECIFIC COMMENTS

Page S-1, 2nd paragraph. Please explain why it is necessary to mimic the historic magnitude and duration of the natural hydrograph. We can understand the historic shape and timing aspects, but water development in the basin will limit the ability to attain all the statistical parameters. **RESPONSE:** *Mimicry does not mean replication. Mimicking just shape and timing does not fully address the range of issues involved. The shape of a natural hydrograph could be mimicked with 10% of the natural flow, yet that would not meet the conditions needed for mimicry. At issue is the definition of mimicry in terms of each parameter specified. The report attempts to do that for magnitude, duration, frequency, variability and timing.*

Page S-2,, 2nd paragraph. Please clarify this paragraph. The research suggests that Navajo Dam reduced the sediment load and cooled the water reducing the historic habitat. Also, diversion dams further reduced historic habitat by limiting historic migration. It is also clear that the introduction of non-natives has resulted in heavy predation on the young-of-the-year limiting if not preventing any recruitment to the reduced habitat. It needs to be clear that the reasons for the native fish becoming endangered are many and complex. **RESPONSE:** *We agree that reasons why native fish numbers have been reduced are many, and it is a complex issue. The paragraph referenced does not discuss reasons why fish numbers were reduced but rather how Navajo Dam changed the San Juan River.*

Table S-1 and 6.1. The first two sets of flow requirements do not fairly represent the research reported later given some of the arguments noted in #2 above. Also, Block 7 dealing with flows to cue spawning seems to contradict the requirements in Block 12 noting that releases from Navajo Dam are to cool. Clarification and noting some of the downsides or contradictions seems appropriate. **RESPONSE:** *We disagree with your first point concerning #2 above. Block 7 has been changed in response to your, and other, comments*

Page S-5, Recommendation for flows greater than 10,000 cfs. We remain concerned that this recommendation is not justified. Flows of this magnitude bring additional sediment into the river that may clog spawning bars. Inadequate research has been done to quantify both the property damage potential and impacts to spawning bars. **RESPONSE:** *The volume of fine sediment entering the system through overbank flow is not even measurable at high flow in relation to the sediment inflow into the system from the watershed. Erosion of new channels brings in about equal amounts of fine (silt/sand) and coarse (gravel/cobble) sediments, while high flows typically remove at least 10 times as much fines as coarse sediments. The flooding remains in the active flood plain as identified by the Corps of Engineers (estimated capacity at Shiprock of 14,000 cfs), so property damage is confined to areas that have historically flooded with some regularity. The impact to spawning bars is positive not negative.*

Page S-8, Flood Control Releases. Clarification needed, we fail to understand how flood control releases can be delayed until after September 1. Not sure this recommendation is achievable as a practical matter. **RESPONSE:** *The flood control releases are those that occur after those required during spring runoff. They are the result of maintaining the required target space in the reservoir at certain times of the year, according to the flood control requirements specified by the Corps of Engineers, to prevent reservoir spills. If, for example, the inflow during the late summer and fall raises the reservoir too high to meet the target space necessary to prevent overtopping during spring runoff, water would need to be evacuated before runoff began to prevent a spill. Historically the release is made by increasing the base release over a long period of time. The recommendation on page 8-12 modifies this procedure to release the same required volume in a spike. You will note in the recommendation, that if the release is needed before September 1, it is added to the release hydrograph.*

Page 1-2, first paragraph. Again seek a balanced description of all the factors associated with the decline of the endangered fish. Making reservoirs the primary factor is not supported by the research. The attempts to eradicate the native fish and replace them with a non-native sport fishery were significant factors as well. **RESPONSE:** *All of these factors are mentioned in this paragraph and the balance of the paragraph is correct. The native fish collapsed after the construction of the*

large dams, whereas nonnative fish, and all the other factors, have been around in the basin since the early 1900s. Many experts feel that nonnative fish and other nonflow limiting factors have been exacerbated by habitat degradation due to flow change since the advent of the large dams.

Page 1-2, last complete paragraph, last three sentences. It would seem that all potential limiting factors affecting recovery of endangered fish in the San Juan River should be evaluated and addressed concurrently with the flow recommendations. Please explain why the adoption and implementation of flow recommendations prior to defining and implementing other measures necessary to recover the fish is appropriate and potentially more effective. Potential limiting factors and measures for dealing with these factors should be investigated and discussed concurrently with the flow recommendations. **RESPONSE:** *Flow recommendations where a major effort for the Biology Committee and trying to prepare a document on all the other factors at the same time was too large an effort. The other factors will be considered in the Synthesis Report being prepared in 1999. Some have already been addressed and activities have been started to overcome them (e.g. small populations requiring augmentation and limitation of range resulting in barrier removal). These factors have been considered in making the flow recommendation.*

Page 1-3, last sentence. The ALP Biological Opinion makes reference to achieving 300,000 AF 96% of the time in order for slightly more depletion to occur. Is this condition achieved as part of these flow recommendations? **RESPONSE:** *No. This discussion in the Biological Opinion is based on old hydrology that was completed to reflect the flexibility in the system to meet the needs of the fish. While our releases average more than 300,000 af, they do not occur 96% of the time. This would not result in mimicry of a natural hydrograph.*

Page 2-2. last incomplete paragraph. The flow recommendations assume that San Juan River flows alone can and should be used to maintain the river channel and channel complexity needed for endangered fish habitat. However, the draft report indicates significant changes in watershed conditions in the San Juan River Basin including; reduced suspended sediment loads, changes in river channel vegetation, and changes in the river flow regime. Is it realistic to assume the flow recommendations can overcome all these changes? The Biology Committee should highlight these changed conditions in the executive summary recommend further evaluation of the potential for maintaining the river channel and desired fish habitat conditions. Vegetative controls, watershed management measures such as sediment retention structures, and physical river channel modifications such as bank stabilization may be viable options and the Recovery Program requires that flow be considered in conjunction with non-flow actions. **RESPONSE:** *The flow recommendations are made in light of these changes that have occurred in the basin. For example, without the reduction in sediment load that has occurred in the system, more water may have been*

required to maintain habitat. The other watershed management actions you suggest may have an influence in the future if they could be accomplished, but until they are studied, found practical and effective and implemented, the flow recommendations have to be functional with the system as it presently exists. Bank stabilization is detrimental to the system, not beneficial. The other activities may well be considered under adaptive management in the future.

Page 2-10, second paragraph, second sentence, and page 2-26, second paragraph. The flow recommendations include criteria based on the amount, duration and frequency of flow considered necessary to clean backwaters and maintain low velocity habitat in secondary channels in reach 3. However, it is not clear that using Navajo releases to meet these criteria is an effective use of water. The beneficial effect of the spring releases on fish habitat in reach 3 is often negated by runoff from summer and fall storms. The draft report at page 4-37 states that storm events, not spring runoff conditions, appear to be the dominant factor regulating backwater and other low velocity habitat quality and productivity. Given this, do releases that generate flows that contribute to backwater formation become a lower priority? The Biology Committee should indicate the more important goals of reservoir releases and suggest investigating other measures such as watershed management techniques to reduce sediment loads to the San Juan River instead of relying on large reservoir releases to help scour sediments. Also, construction of passages around barriers to fish movement between Cudei and Farmington would allow endangered fish access to potential spawning and rearing habitat further upstream in the San Juan River, which might lessen the need for lesser quality rearing habitat in reach 3. Creating more access to backwater and spawning habitats upstream could offset losses in backwater habitat in reach 3. Temperature control devises on Navajo Dam outlet works may also be useful. **RESPONSE:** *The beneficial effects of spring releases are not negated by storm flow. If no release is made and storms occur, even more habitat is lost. It is true, that the need for flushing this reach is related to the amount of perturbation that occurs due to storm flow, but the releases are not negated. Productivity of backwaters, not quantity, is more influenced by storm flow than runoff. Maintaining backwaters is a high priority goal of the flow recommendation. The priorities for the flow recommendations are listed in Chapter 7, pages 7-1 and 7-2. The recommendation for flushing of Reach 3 assumes that passage will be constructed. Since the potential spawning locations have been moved down river by 50 miles by the construction of Navajo Dam, assuming barrier removal (100 miles without), and the bottom 77 miles of historic nursery habitat has been lost, to suggest that Reach 3 is not needed would be irresponsible given on our present knowledge of the system.*

Page 3-27. first paragraph. The draft report at pages 3-31 through 3-35 indicates that channel catfish and common carp use the same habitats used by Colorado squawfish and other native fish. Therefore, flow management for native fish habitat could also benefit non-native fish. The draft

report at page 4-8 1, last paragraph, indicates that non-native channel catfish and carp populations are not negatively affected by mimicry of the natural hydrograph. This suggests that implementing the flow recommendations might not be a very effective recovery action unless accompanied by actions to remove non-native fish from the river. The report should at least indicate that the amount of streamflow needed to conserve the endangered fish in the San Juan River might be reduced if actions taken to control non-native fish populations prove effective. **RESPONSE:** *Channel catfish and common carp have been in the Colorado Basin since the late 1800s. Their influence on native fish appears to be most problematic in areas with poor habitat. Hence, by improving habitat for native fishes, nonnatives become less of a concern. The flow recommendations were made to improve habitat for native fish. In the future, if specific flow features can be linked to reduction of nonnatives, they will be tested if they fit within the overall goal of mimicry of the natural hydrograph.*

Page 4-14, last incomplete paragraph. Again, language to help justify a flow recommendation of greater than 10,000 cfs is suggested to maintain channel complexity. Again, we note that flows greater than bankfull spread onto the floodplain and do not add substantial energy for transporting cobble or forming cobble bars. Furthermore, they may contribute debris and sediment to river that must then be flushed. Flows greater than bankfull may also cause property damage and this potential has not been fully investigated based on statements made at the last Coordination Committee meeting. Based on this information flow recommendations greater than 8,000 c.f.s should not be included at this time and we continue to urge there removal until the needs and risks for creating these flows are fully understood. **RESPONSE:** *See previous responses to this issue of out-of-bank flooding. The need is based on mimicry of the most modified portion of the hydrograph, supported by the findings reported on pages 4-11 to 4-12.*

Page 4-28, last full paragraph. Again, there is language suggesting flows above 10,000 cfs are helpful in maintaining channel complexity, providing new cobble sources for subsequent bar construction and maintaining floodplain integrity. Yet, on the top of page 4-29 it states, "Percent cobble substrate has increased with time, cobble is abundant in the system, the cobble bars surveyed do not appear to be degrading, and open interstitial space is consistently maintained. The first sentence of the next paragraph indicates that backwaters flush at 4,000 to 5,000 cfs thereby questioning the need for flows grater than this level. **RESPONSE:** *The observations include results where the 10,000 cfs condition has been met two of seven years, which is greater than recommended. Therefore, the observations of the channel condition include the response to these flows.*

Page 4-40, last incomplete paragraph, first sentence; page 4-41, first complete paragraph, first five sentences; and page 6- 1, first paragraph. There were so few YOY Colorado squawfish collected in

the San Juan River during the 1987-1996 period that it is not fair to draw conclusions relating spawning success to spring runoff. Consequently, it is also difficult to conclude from these few fish and different sampling techniques that spawning success is significantly correlated to spring runoff volume. The report so indicates at page 4-41. This fact should be a major consideration and reason to limit the high flow recommendations at this time. **RESPONSE:** *This section has undergone considerable change as the Biology Committee has investigated this information. It is the consensus of the Biology Committee that the way this information is presented is accurate. The fact that it fits with what has been learned in other Upper Basin rivers lends credence to the conclusions in the San Juan Basin.*

Figure 6.1. Good idea but some information appears out of place. For example, under Bluehead Sucker the spawning should probably be under the "runoff" time slot rather than the "base flow" slot. Please review. **RESPONSE:** *Bluehead sucker are the last sucker to spawn, and hence they spawn after the peak flow period as flows are being reduced to base flow.*

Page 6.6. Red shiner abundance increased with the number of days flows were above 8,000 cfs. This is a downside to flows of 8,000 cfs or more for longer than 8 days and argues for a shorter duration of bankfull flows along with the bank erosion that occurs at this flow. **RESPONSE:** *We are not sure this is a downside, since this observed increase was only in secondary channels and the increased density of red shiner does not perpetuate itself beyond one year.*

Page 6.6 Summer flow spikes could negatively impact native YOY **RESPONSE:** *We agree as stated on page 6-6.*

Page 6-7. More high flow language to consider. **RESPONSE:** *See above responses to same comment.*

Page 7-1. If controlling habitats are either backwaters or cobble bars, why introduce more sediment into the system when it is not needed. **RESPONSE:** *See earlier responses to the high flow issue.*

Page 7-2. More high flow language to reconsider. **RESPONSE:** *See above responses to same comment.*

Page 7-6: If squawfish spawning did occur during a period where the 8,000 c.f.s condition for 8 days was not met, then why should this criteria be implemented. This is a "biological-response" driven model and a biological response was observed with less than the required condition. Backwater habitat is optimal at between 6,000 and 7,000 cfs. **RESPONSE:** *8,000 cfs is not required each year,*

but only 1 in 3 years to build bars, with periods as long as 6 years allowable between events. 2,500 cfs is adequate for maintaining spawning conditions on existing bars in between the years with bar building flows. Therefore, the "response" is consistent with the recommendation.

Page 7-8 A frequency of 1 year in three does not appear to be ample consideration for an extended drought. **RESPONSE:** *Agreed. This is the average over a 65-year period of record. We allow 6 years without meeting the conditions during drought periods.*

Page 7-9 last sentence of third paragraph under "River Operations": the RiverWare model should be used for Section 7 consultations but it is very difficult to operate. At the present time only Keller-Bliesner Engineering with cooperation from USBR are able to run the model. It is probably not realistic to have an applicant operate the model. A recommendation for the Coordination Committee to develop a process for using the model in consultations and maintaining it would be appropriate. **RESPONSE:** *We have provided a description of how the tool may be used. The Coordination Committee may develop any procedure for use that they see appropriate. Any use in the Section 7 process would be with the approval of Fish and Wildlife Service.*

Page 7-9. It is noted that a fourth controller for water ownership and accounting is being developed. This means that water rights are not supported in the model at present, only depletions. As a result the advantages of lagging return flows is not fully supported and exchange type operations can not by implemented. Also, operations of Electra Lake and other smaller facilities were ignored. This controller when completed will help to significantly improve the identification of project impacts rather than limiting them to a strict examination of depletions. **RESPONSE:** *The model in its present form cannot consider the administration of water rights or accurately represent priority. The addition of the fourth controller would help that ability. The limitation was not significant to the flow recommendation process.*

Page 7-13. The report should explain why Phase I, Stage A of ALP is not shown as 57,100 but as 56,610 AF which is less than the Biological Opinion for the project currently provides. Also, depletions under the 57,100 AF scenario only occur to the Animas and San Juan. We need a full project at 146,000 AF to impact the La Plata. **RESPONSE:** *The results were modeled exactly as they were for the Section 7 Consultation for ALP. Language has been added to indicate the limitations of those model results and reflect the difference between the representation and the planned project depletion.*

Page 7-17. Language here highlights that the "depletion base" is not equivalent to the "environmental baseline." This issue needs to be resolved with the USFWS and is a good argument

for review of the recommendations at the end of 1-year. **RESPONSE:** *We agree as noted on p. 8-27. This is a Coordination Committee issue.*

Pages 7-18 and 7-19. Table 7.3. The depletion estimates have changed for Colorado largely because we know have better information. This should be noted in the report. Furthermore, the added depletion levels even though selected projects were used for modeling purposes do not represent a right for that particular entity to claim a right to that depletion. New depletions are available to any entity on a first come first serve basis. **RESPONSE:** *We recognize your position. Due to the sensitivity of issues concerning the changes from the environmental baseline for ALP, we have elected to not discuss the reasons for the change, but simply state that "corrections" were made.*

Page 8-1, last paragraph. This paragraph suggests a few conditions under which flow recommendations for the San Juan River may be modified in the future. The Coordination Committee has not yet discussed the implementation of the flow recommendations, including criteria for modifying them. Again, these are good reasons for a review at the end of one year. **RESPONSE:** *This has been edited to reflect that it is a recommendation.*

Page 8- 3, table 8. 1. The frequency distribution values shown in table 8.1 represent both primary and secondary flow-duration criteria for the San Juan River. The sole support for the secondary flow duration criteria are the hydrologic modeling results for different water depletion scenarios given by the draft report at pages 8-13 and 8-14, figures 8.2 through 8.5, from which the numeric frequency values were selected based on modeled trends of flow-duration frequencies. The report should either present further evidence in the form of actual gage record to support the secondary flow criteria, or the secondary criteria (and table 8.1) should be deleted from the report. **RESPONSE:** *While the table was produced by examination of modeling results that approached the threshold primary values, providing the variability listed will provide variability that was judged adequate for the purposes of mimicry. Had the natural distribution (available from an analysis of the gage data) been used (See Figures 8.3 through 8.10) these secondary criteria would have controlled the recommendation rather than the primary condition. Therefore, the variability requirements were described such that the primary criteria would always control.*

Pages 8-2 through 8-7, section entitled "Recommended Hydrograph Conditions." The report needs to address comments above as appropriate in this section. Flow recommendations should be reconsidered after a year as suggested at the last Coordination Committee meeting. **RESPONSE:** *This section has been edited to improve description of the flow recommendations. Inadequate additional data will be available to reconsider these recommendations in one year.*

Pages 8-6. In the first paragraph under operating rules, revise the sentence, "**As noted in Chapter 7, the use of these hypothetical water development scenarios does not imply any right to develop, any priority of development, or any priority for consultation. Neither do these scenarios attempt to exclude others from developing.**" **RESPONSE:** *The suggested changes have been made.*

Page 8-7, first bullet. Please clarify that you anticipate always ramping up and down from and to 1,000 cfs and not some lesser flow rate like 500 cfs. Also include a definition for the term "perturbation" here. Finally, you need to recommend that the Coordination Committee establish who will be responsible for determining who operates and maintains the model for consultation and RIP purposes. **RESPONSE:** *The clarification is provided in Tables 8.2 and 8.3. The ramp rates never exceed 1,000 cfs per day but they may be less and they follow different timing, depending on the ramping duration. It would be difficult to explain narratively.*

Tables 8.11 to 8.14 are missing data. **RESPONSE:** *Do you mean Figures? The Figures have been corrected.*

In closing, the Coordination Committee must discuss how the flow recommendations will be implemented both in the field and in section 7 consultations. The impacts of the flow recommendations on water development in the San Juan Basin must be fully understood.

Thank you for the opportunity to comment on the latest draft, we look forward to your responses.

Sincerely

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